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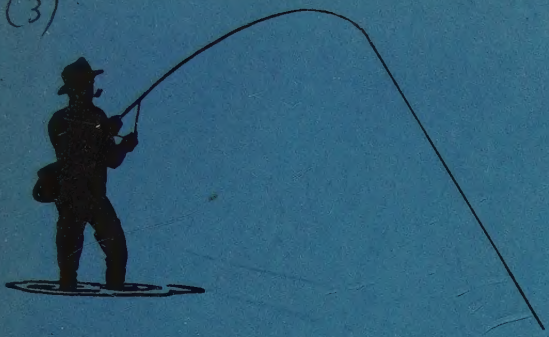

SPORT FISHERY ABSTRACTS

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DEPARTMENT OF THE INTERIOR
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BUREAU OF SPORT FISHERIES AND WILDLIFE

UNITED STATES DEPARTMENT OF THE INTERIOR

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BUREAU OF SPORT FISHERIES AND WILDLIFE

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Prepared in the Division of Fishery Research

Narragansett, Rhode Island

SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

Vol. 15, No. 3 Abstracts 12159 - 12483 1970

Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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12159. Libraries, The, U. S. Department of the Interior. 1970. MERCURY CONTAMINATION IN THE NATURAL ENVIRONMENT. A COOPERATIVE BIBLIOGRAPHY. U. S. Dept. of the Interior, Office of Library Services, Washington, D. C., 32 p.

Environmental contamination by mercury is a current concern of many bureaus and offices of the U. S. Department of the Interior. The purpose of this bibliography is to provide access to the literature related to this subject for those people who are now beginning to work on the problem. Publications providing background and current information on the aspects of greatest concern to the Department have been selected from the large body of literature on mercury. English language material relating to fish, wildlife and water pollution has been given full coverage from the sources consulted. So large a body of literature exists on other phases of the problem, such as methods of analysis, agricultural uses, industrial health, and clinical medicine, that it could not all be included. The criteria for selection in these areas were close relationship to environmental contamination, recommendations of scientists, or the presence of literature reviews or substantial bibliographies. The literature was searched from 1960 to the present. Some particularly relevant pre-1960 titles have been included. -- From compilers' preface.

12160. Uthe, J. F., F. A. J. Armstrong, and M. P. Stainton (Fisheries Res. Bd. of Canada, Freshwater Institute, Winnipeg, Manitoba, Canada). 1970. MERCURY DETERMINATION IN FISH SAMPLES BY WET DIGESTION AND FLAMELESS ATOMIC ABSORPTION SPECTROPHOTOMETRY. J. Fish. Res. Bd. Canada, 27(4): 805-811.

A simple, rapid method is given for determination in fish of mercury at concentrations measured in parts per million (ppm). Samples are digested at 50-60 C with sulphuric acid and oxidized with permanganate. Mercury in the digest is determined by atomic absorption spectrophotometry. Recovery of mercury added to samples was complete, with good precision. Standard deviations from triplicate analyses were $\pm$ 0.039 at the 0.1 ppm level and $\pm$ 0.051 at the 0.5 ppm level. In a day, three workers analysed 15-20 samples in triplicate. (Authors)

12161. Wobeser, G., N. O. Nielsen, R. H. Dunlop, and F. M. Atton (Western College of Veterinary Medicine, Univ. of Saskatchewan, Saskatoon, Sask., Canada). 1970. MERCURY CONCENTRATIONS IN TISSUES OF FISH FROM THE SASKATCHEWAN RIVER. J. Fish. Res. Bd. Canada, 27(4): 830-834.

Muscle tissue of 81 fish from several locations in the Saskatchewan River system contained an average of more than 1.0 ppm of mercury. Fish collected at two sites had much higher concentrations, with individual fish containing up to 11.2 ppm. The concentrations found were higher than those reported for fish from uncontaminated environments, and corresponded to values reported for Scandinavian fish collected in areas of industrial pollution. (Authors)

12162. Eisler, Ronald (U. S. Bur. of Sport Fisheries and Wildlife, Fish-Pesticide Research Program, Sandy Hook Marine Lab., Highlands, New Jersey). 1970. ACUTE TOXICITIES OF ORGANOCHLORINE AND ORGANOPHOSPHORUS INSECTICIDES TO ESTUARINE FISHES. U. S. Dept. of the Interior, Bur. of Sport Fisheries and Wildlife Technical Paper No. 46, 12 p.

Static 96-hour bioassays with 12 insecticides and seven species of estuarine teleosts (American eel, Anguilla rostrata; mummichog, Fundulus heteroclitus; striped killifish, Fundulus majalis; bluehead, Thalassoma bifasciatum; striped mullet, Mugil cephalus; Atlantic silverside, Menidia menidia; northern puffer, Sphaeroides maculatus) were conducted at 24 °/oo salinity, 20°C., and pH 8.0. Endrin was consistently the most toxic and methyl parathion consistently the least toxic compound tested. The descending order of insecticide toxicity to fishes at 96 hours was endrin, p, p'-DDT, dieldrin, aldrin, dioxathion, heptachlor, lindane, methoxychlor, Phosdrin, malathion, DDVP, and methyl parathion. Concentrations fatal to 50 percent of each species in 96 hours (LC50 values) ranged from 0.05 to 3.1 micrograms per liter (ppb) active ingredients with endrin, 0.4 to 89 ppb with p, p'-DDT, 0.9 to 34 ppb with dieldrin, 6 to 75 ppb with dioxathion, 0.8 to

194 ppb with heptachlor, 9 to 66 ppb with lindane, 12 to 150 ppb with methoxychlor, 65 to 800 ppb with Phosdrin, 27 to 3,250 ppb with malathion, 225 to 2,680 ppb with DDVP, and 5,200 to 75,800 ppb with methyl parathion. (Auth.)

12163. Eisler, Ronald (U. S. Bur. of Sport Fisheries and Wildlife, Fish-Pesticide Research Program, Sandy Hook Marine Lab., Highlands, New Jersey). 1970. FACTORS AFFECTING PESTICIDE-INDUCED TOXICITY IN AN ESTUARINE FISH. U. S. Dept. of the Interior, Bur. of Sport Fisheries and Wildlife Technical Paper No. 45, 20 p.

Factors affecting mortality caused by organochlorine and organophosphorus insecticides in the mummichog, Fundulus heteroclitus, include duration of exposure, concentration and class of chemical, degradation or alteration of experimental compounds in seawater, and temperature, salinity, and pH of the medium. Static bioassays with organochlorine (endrin, aldrin, dieldrin, heptachlor, p,p'-DDT, lindane, methoxychlor) and organophosphorus (malathion, DDVP, methyl parathion, Phosdrin, dioxathion) insecticides were conducted on mummichogs at 24 $^{o}/_{oo}$ salinity, 20°C, and pH 8. Heptachlor, Phosdrin, methyl parathion, and lindane were 4.6 to 12.5 times as toxic to mummichogs at 240 hours as at 96 hours. In another study, most of the mummichogs that survived high (LC75, 24h) levels of organochlorine insecticides for more than 120 minutes or organophosphorus compounds for more than 30 minutes died by day 21 postexposure. Shorter exposures produced fewer deaths. In holding studies, mortality was high during a 240-hour observation period following 96-hour exposure. This was especially pronounced among lots initially immersed in high concentrations of aldrin, methyl parathion, and heptachlor. Most pesticides were less toxic to mummichogs after 96 hours than after 45 minutes in aerated seawater, especially aldrin, malathion and heptachlor; the reverse was true for Phosdrin and methyl parathion which were about five times as toxic. Temperature, salinity, and pH of the medium all influence pesticide-induced mortality. The toxicity of organophosphorus insecticides to mummichogs was directly proportional to temperature between 10° and 30°C and to salinity between 12 $^{o}/_{oo}$ and 36 $^{o}/_{oo}$ and inversely proportional to pH in the range 5.5 to 10. Toxicity of organochlorine insecticides to mummichogs was greatest at intermediate temperatures (20°-25°C) and least at intermediate pH (7-8) within the ranges tested. Salinity of the medium had little or no measurable effect on toxicity. (Auth.)

12164. Patten, Benjamin G., Richard B. Thompson, and William D. Gronlund (Bur. of Comm. Fisheries Biological Lab., Seattle, Washington). 1970. DISTRIBUTION AND ABUNDANCE OF FISH IN THE YAKIMA RIVER, WASH., APRIL 1957 TO MAY 1958. U. S. Dept. of the Interior, U. S. Fish Wildl. Serv., Special Scientific Report - Fisheries No. 603, 31 p.

Fish were collected from the main stem (lower 281 km.) of the river at 2-month intervals. Native fish consisted of six families, with 23 species and three hybrids; exotic fish consisted of five families with 10 species. The water temperature from the mouth of the river to 145 km. upstream was high in summer compared with the stretch between km. 153 and 281. Eleven species were taken principally from the lower 145 km. of the river; 14 other species were taken mostly from the upper area. The greatest numbers of fish were collected from the mouth to km. 64 and from km. 120 to 177. These abundances coincided with centers of abundance of the families Cyprinidae and Catostomidae. Centrarchids were abundant below km. 97, and Cottidae and Salmonidae were most abundant above km. 161. The fewest fish were collected between km. 72 and 89, possibly because of slow current, high summer temperatures, and a muddy bottom. Seasonal distribution and abundance of each species are discussed. Although cyprinids and catostomids were the most abundant fish, salmon (genus Oncorhynchus) and trout(genus Salmo) are the most common from km. 153 to 281. (Authors)

12165. U. S. Dept. of the Interior, Bur. of Commercial Fisheries. 1970. LIST OF FISHERY COOPERATIVES IN THE UNITED STATES 1969-70. U. S. Fish and Wildlife Service Fishery Leaflet No. 627, 13 p.

12166. Nikolskii, George V. 1969. THEORY OF FISH POPULATION DYNAMICS. Oliver & Boyd, Tweeddale Court, 415 High St., Edinburgh 1, Scotland (n. d.), 323 pp. 170s, (Michael Holden, reviewer); New Scientist, 44(678), 521; Commercial Fisheries Abstracts, 23(3): p. 15.

This book is the English version of a work published in Russian in 1965. It is not just another repetitious treatment of familiar material. It is not a handbook showing how to get a set of parameters and fit them to a formula--in point of fact, complex mathematical equations are absent. Rather, it expounds the view that fish population dynamics should be developed by biologists as well as mathematicians, for living systems are involved. The author deals with the components of population dynamics, chapter by chapter, by reviewing the literature and summing up the conclusions that can be drawn from the data presented. This method of treatment is valuable in that it draws attention to the work, both marine and fresh water, that has been done on the subject. The chapter entitled "Principles for Raising the Productivity of Fish Populations" is of especial value to people concerned with the international regulation of fisheries in the North Atlantic. -- L. Baldwin.

12167. Pickford, Grace E., F. Blake Grant, and Bruce L. Umminger (The Bingham Laboratory, Dept. of Biology, Yale Univ., New Haven, Connecticut). 1969. STUDIES ON THE BLOOD SERUM OF THE EURYHALINE CYPRINODONT FISH, Fundulus heteroclitus, ADAPTED TO FRESH OR TO SALT WATER. Trans. Conn. Acad. Arts Sci., No. 43, 25-70 (Archon Books, The Shoe String Press, Inc., 995 Sherman Ave., Hamden, Conn. 06514); Commercial Fisheries Abstracts, 23(3): p. 22.

This study was initiated by the senior author when it became evident that fresh-water adaptation in Fundulus heteroclitus was dependent upon the presence of the pituitary. Failure of hypophysectomized F. heteroclitus to survive in fresh water was correlated with an inability of the fish to maintain normal levels of serum chloride. The present authors carried out a more complete study of the normal constituents of the serum in intact fish adapted to either salt water or fresh water. All tests were made on parallel groups of fish adapted to salt water or fresh water under otherwise similar laboratory conditions. In most of the tests, sufficient serum was pooled from 2 to 5 fish to permit at least 8 different constituents to be measured on the same sample. The physiochemical properties (serum osmolality, blood pH, and plasma specific gravity), serum ions (Na^+, K^+, Ca^{++}, Mg^{++}, Cl^-, PO_4^{--}, and HCO_3^-), and serum organic constituents (glucose, nonglucose carbohydrate, urea, total amino acids, total nonprotein-nitrogen, total proteins and electrophoretic fractions, total cholesterol, total phosphate, and estimated phospholipid) were studied in samples of the blood of the parallel groups of salt water--or fresh water--adapted male F. heteroclitus maintained under constant laboratory conditions (20°C., 8 hours per day of light, daily feeding). The results revealed little or no differences in the composition of the serum of the fish that could be related to sexual maturation, although there was a slight trend to lower serum osmolality. -- F. T. Piskur.

12168. Anderson, Herbert G., Jr. (U. S. Bur. of Sport Fisheries and Wildlife, Sandy Hook Marine Lab., Highlands, New Jersey). 1970. ANNOTATED LIST OF PARASITES OF THE BLUEFISH Pomatomus saltatrix. U. S. Dept. of Interior, Bur. of Sport Fisheries and Wildlife Technical Paper No. 54, 15 p.

In this study of bluefish on the Atlantic coast, 22 of the 31 previously recorded parasites of bluefish were observed and 6 not previously recorded--a total of 37 parasites, 16 of frequent occurrence. (Auth.)

12169. U. S. Department of the Interior, Bureau of Commercial Fisheries. 1970. AVAILABLE FISHERY BULLETINS OF THE U. S. FISH AND WILDLIFE SERVICE. U. S. Dept. of the Interior, U. S. Fish and Wildlife Service Fishery Leaflet No. 628, 11 p.

12170. Hughes, Steven E. (Bur. of Comm. Fisheries, Exploratory Fishing and Gear Research Base, Seattle, Washington). 1970. ANNOTATED REFERENCES ON THE PACIFIC SAURY, Cololabis saira. U. S. Dept. of the Interior, U. S. Fish and Wildlife Service Special Scientific Report - Fisheries No. 606, 12 p.

The pertinent literature on the saury is reviewed, because of the recent interest in developing a fishery for this species along the west coast of the United States. Over three-fourths of the 72 references concern Japanese or Soviet reports on their saury stocks and fishing industries. The annotations briefly describe the nature of the research and summarize the important results or conclusions. A subject-author index is provided. (Auth.)

12171. Erickson, Paul A., and John T. Reynolds (Massachusetts Univ., Amherst, Water Resources Research Center, Amherst, Mass.). 1969. VERTICAL AND HORIZONTAL DISTRIBUTION OF PHYTOPLANKTON IN QUABBIN RESERVOIR. Interim Report, Mass. Water Resources Research Center, Publication No. 9, 44 p, 19 fig. Available from the Clearinghouse as PB-189 765, $3.00 paper copy, $0.65 microfiche; Selected Water Resources Abstracts, 3(11), p. 38, 1970.

Phytoplanktonic data collected incidentally to the aims of the studies on eutrophication in Quabbin Reservoir are a significant addition to the knowledge of the characteristic phytoplankton in this major Massachusetts Reservoir. Four distinct areas are defined in terms of the horizontal and vertical distribution of three types of phytoplankton and these areas seem to correspond to subdivisions of the reservoir which can be made on the basis of other physical and chemical data. While such areas may or may not prove to be of general ecological significance in the light of more exhaustive studies, even preliminary evidence of consistent phytoplanktonic differences throughout the reservoir might help to define the aims and direct the efforts of any future study of eutrophication in Quabbin. Information on such differences is particularly important today because diversions of water into Quabbin from polluted sources such as the Connecticut River are being contemplated, and because the basis for a measurement of the efficiency and effect of treatment plants constructed as part of those diversions will be a knowledge of microbial population patterns in Quabbin prior to the mixing.

12172. Whitworth, Walter R., and David H. Bennett (Dept. of Fisheries, Connecticut Univ., Storrs, Connecticut). 1970. A LIMNOLOGICAL STUDY OF THE LOWER FARMINGTON RIVER WITH SPECIAL REFERENCE TO THE ABILITY OF THE RIVER TO SUPPORT AMERICAN SHAD. Inst. of Water Resources, Univ. of Conn. Report No. 9, 57 p.; Selected Water Resources Abstracts, 3(11): p. 39, 1970.

Fish plankton, bottom fauna, and water were sampled in the Lower Farmington River as part of a comprehensive limnological survey. Water temperature, B.O.D., rate of slide colonization tests, estimates of community metabolism and effects of effluents were studied. Laboratory and field bioassays using various fish were conducted with effluents common to the Farmington River. The effects of fluctuating DO levels on hatching of shad eggs were studied. Shad were transferred into the River and from the data collected the authors conclude that the River is capable of supporting a significant shad run, and should not be measurably affected by the effluent discharge. A set of 5 recommendations concerned with building the shad runs is presented. -- Katz and Sjolseth

12173. Templeton, W. L., C. D. Becker, J. D. Berlin, C. C. Coutant, and J. M. Dean (Pacific Northwest Labs., Battelle Memorial Inst., Richland, Washington). 1969. BIOLOGICAL EFFECTS OF THERMAL DISCHARGES: ANNUAL PROGRESS REPORT FOR 1968. Reprint from Pacific Northwest Lab. Annual Report for 1968 to USAEC Div. of Biology & Medicine, Vol. 1: Life Sciences. USAEC Research and Development Report No. BNWL 1050, 49 p.; Selected Water Resources Abstracts, 3(11): p. 40, 1970.

This is the second annual report issued by Battelle-Northwest's Aquatic Ecology Section which deals exclusively with research to determine the effects of thermal additions to aquatic environments. The individual papers, all separately abstracted, include the following titles: Responses of Salmonid Fishes to Acute Thermal Shock,

Passage of Downstream Migrants, Chinook Salmon Spawning Near Hanford - 1968, Gull Predation in a Reactor Discharge Plume, Effects of Chronic Variable Water Temperature on Survival and Growth of Young Chinook Salmon, Behavior of Sonic-Tagged Chinook Salmon and Steelhead Trout Migrating Past Hanford Thermal Discharges, The Food and Feeding of Juvenile Chinook Salmon in the Columbia River at Hanford, Columnaris Exposure and Antibody Development Among Upstream Migrant Salmonids, Oral Immunization of Juvenile Coho Salmon Against Chondrococcus Columnaris, The Response of Juvenile Salmonids to Acute Thermal Shock, and Alterations in Hepatocyte Function of Thermally Acclimated Rainbow Trout (Salmo gairdneri).

12174. Coutant, C. C. (Battelle-Northwest, Richland, Washington). 1969. RESPONSES OF SALMONID FISHES TO ACUTE THERMAL SHOCK. In Biological Effects of Thermal Discharges: Annual Progress Report for 1968, pp. 1-8; Selected Water Resources Abstracts, 3(11): p. 40, 1970.

Chinook salmon, coho salmon, and rainbow trout were subjected to acute thermal shock in order to determine any relationships between times to equilibrium loss and death of fish populations. There is a variation with test temperature in the relationship between times to equilibrium loss and death in juvenile chinook salmon and rainbow trout. Chinook salmon and rainbow trout undergo increased predation at sublethal exposures to lethal temperature. Equilibrium loss due to thermal shock is not reversible at all lethal temperatures, for the studies show large delayed mortality of rainbow trout 24 hours after exposure to 27-30 deg C. Above 30 deg C equilibrium loss is reversible. Thermal resistance differences between juvenile and large coho and chinook salmon in addition to species differences were found. Above 28 deg C juvenile chinook are most sensitive, then juvenile coho, adult coho and adult chinook and below 28 deg C it is adult coho, juvenile chinook and juvenile coho the least sensitive. -- Sjolseth

12175. Coutant, C. C., C. D. Becker, and E. F. Prentice (Battelle-Northwest, Richland, Washington). 1969. PASSAGE OF DOWNSTREAM MIGRANTS. Biological Effects of Thermal Discharges: Annual Progress Report for 1968, pp. 9-12; Selected Water Resources Abstracts, 3(11): p. 41, 1970.

Juvenile chinook salmon were confined to live boxes which were drifted through reactor discharge plumes below Hanford on the Columbia River. No direct or 24 hour latent mortalities were induced during spring and summer. Shoreline areas affected by intragravel seepage of heated water reached lethal levels for chinook. In these areas losses of test fish during mid-summer occurred. Most temperature rises did not exceed the ultimate incipient lethal level for the species. Emigrating juvenile chinook trapped in May following passage through the warmest part of the thermal discharge plume showed no mortality, equilibrium loss or 'gas bubble' disease. The authors feel that most emigrating juvenile salmon are successful in passing areas of maximum thermal change at Hanford. -- Sjolseth

12176. Olson, P. A., and R. E. Nakatani (Battelle-Northwest, Richland, Washington). 1969. EFFECTS OF CHRONIC VARIABLE WATER TEMPERATURES ON SURVIVAL AND GROWTH OF YOUNG CHINOOK SALMON. Biological Effects of Thermal Discharges: Annual Progress Report for 1968, pp. 17-20; Selected Water Resources Abstracts, 3(11): p. 41, 1970.

Fertilized eggs from five pairs of chinook salmon were taken and exposed to six different temperature regimes following the Columbia River's seasonal pattern and expressing different heating rates on a cumulative weekly basis during early development. A constant temperature increment above base river temperatures of 2.5 deg C caused slightly increased egg mortalities. An eventual 5 deg C increment above base river temperatures produced no increased mortality in the majority of spawns when added by 20 cumulative weekly increments of 0.25 deg C, although increased mortality occurred if this 5 deg C rise was done at 0.5 deg C for 10 weeks. It was noticed that warmer water conditions resulted in increased growth rates. -- Sjolseth

12177. Coutant, C. C. (Battelle-Northwest, Richland, Washington). 1969. BEHAVIOR OF SONIC-TAGGED CHINOOK SALMON AND STEELHEAD TROUT MIGRATING PAST HANFORD THERMAL DISCHARGES. Biological Effects of Thermal Discharges: Annual Progress Report for 1968, pp. 21-26; Selected Water Resources Abstracts, 3(11): p. 41, 1970.

Eighty-nine chinook salmon and 279 steelhead were marked with sonic tags to determine their pathways of spawning migrations as they move through the warm waters surrounding the Hanford facilities. The fish were found to migrate mainly along the shoreline, principally utilizing the left bank opposite the reactors during peak river temperatures. No statistical difference was found between migration rates of the two species or between rates along shorelines inside and outside the reactors' thermal influence. Average migration rates were studied and found to be distinctly non-uniform. The authors feel there is insufficient data available to identify the causes of anomalies in distribution and migration rate. -- Sjolseth

12178. Becker, C. D. (Battelle-Northwest, Richland, Washington). 1969. THE FOOD AND FEEDING OF JUVENILE CHINOOK SALMON IN THE COLUMBIA RIVER AT HANFORD. Biological Effects of Thermal Discharges: Annual Progress Report for 1968, pp. 27-31; Selected Water Resources Abstracts, 3(11): p. 41, 1970.

Stomach contents of 445 young chinook salmon taken near Hanford were examined. They fed primarily upon aquatic insects, mainly chironomids, and secondarily on terrestrial insects. No evidence was found to suggest that heated effluents discharged in midwater plumes and which rapidly mix with the colder river water adversely affect either insect production or feeding activity of fish. Food intake was restricted in a few shoreline areas receiving warm water via intragravel seepage. The author feels that thermal discharge to the river, when waters are below preferred levels during spring runoff, may actually benefit the fish. -- Sjolseth

12179. Dean, J. M. (Battelle-Northwest, Richland, Washington). 1969. THE RESPONSE OF JUVENILE SALMONIDS TO ACUTE THERMAL SHOCK. Biological Effects of Thermal Discharges: Annual Progress Report for 1968, pp. 41-46; Selected Water Resources Abstracts, 3(11): p. 41, 1970.

Juvenile coho and chinook salmon were acclimated at 10, 15, or 20 deg C and transferred in lots of ten to water temperatures of 25-30 deg C. Temperature acclimation will shift the thermal limits of behavioral and physiological responses. The absolute limits differed for various species of salmonids but the overall response was similar. The author stressed the need for more observations of the reactions of organisms to thermal stress so that adequate thermal criteria can be established. Sjolseth

12180. Smith, Lloyd L. (Dept. of Entomology, Fisheries and Wildlife, Minnesota Univ., St. Paul, Minnesota). 1969. EFFECT OF EUTROPHICATION ON FISH AND RELATED ORGANISMS. Water Pollution by Nutrients--Sources, Effects and Control, Water Resources Research Center, Univ. of Minnesota, Minneapolis, WRRC Bull. 13, pp. 15-18; Selected Water Resources Abstracts, 3(11): p. 43, 1970.

Eutrophication is considered in the framework of fish management, excluding aesthetic considerations and views only effects on total fish populations. Before adverse levels of eutrophication eliminate certain areas from active fish production, nutrient additions increase fish biomass per acre. Often increased production will be accompanied by adverse aesthetic effects. The principal disadvantage of eutrophication to fish is lowering the oxygen supply to 5 parts per million or lower. Below 5 ppm the harvestable crop is reduced and existence of desirable deep cold water species is threatened with a shift to less desirable warm water species. Increasing amounts of hydrogen sulfide produced by decomposing beds of detritus could be lethal to fish and fish eggs. Eutrophication would increase production, while at the same time accelerate natural mortality and shift in species by high hydrogen sulfide concentrations. Long term effects of eutrophication would be increased protein production because of higher annual production of less desirable warm water fish species. -- Bannerman

12181. Prowse, G. A. (Fish Culture Research Training Inst., Malacca, Malaysia). 1969. THE ROLE OF CULTURED POND FISH IN THE CONTROL OF EUTROPHICATION IN LAKES AND DAMS. Verhandlungen der Internationalen Vereinigung fur Theoretische und Angewandte Limnologie, Vol. 17, pp. 714-718; Selected Water Resources Abstracts, 3(11): p. 51, 1970.

Less desirable enrichment effects of the hydrosphere with plant nutrients include excessive growths of various aquatic macrophytes, and of algae, usually blue-greens. In certain situations, introduction of cultured pond fishes offers a means of controlling those manifestations of eutrophication. Criteria for suitable candidates include: (1) fish should be planktophagous or herbivorous; (2) they should not create a nuisance by spreading; (3) they must co-exist peacefully with other species without detriment to latter; (4) they must maintain their numbers in face of predation; and (5) they must tolerate existing temperature conditions. Among suitable choices of macrophyte-feeders are Tilapia zillii, T. melanopleura, and the grass carp, Ctenopharyngodon idellus. Tilapia will not tolerate temperatures below 10 C, but are very fecund under tropical conditions. Ctenopharyngodon has wide temperature tolerance but its spawning must be induced artificially with pituitary injections. Suitable planktophages include Tilapia mossambica and related species, and silver carp, Hypophthalmichthys molitrix. These Tilapia do not thrive below 13 C, but spawning of silver carp is easier than with Ctenopharyngodon. Combinations of planktophages and herbivores are often desirable. In eutrophic brackish lakes, like Lake Onondaga, New York, various mullets (Mugil) might be suitable planktophages. -- Eichhorn

12182. Ebel, Wesley J. (Bur. of Comm. Fisheries Biological Lab., Seattle, Washington). 1970. SUPERSATURATION OF NITROGEN IN THE COLUMBIA RIVER AND ITS EFFECT ON SALMON AND STEELHEAD TROUT. U. S. Dept. of the Interior, U. S. Fish & Wildl. Service Fishery Bull. 68(1):1-11.

The nitrogen gas regime in the Columbia River was studied in 1966 (from Grand Coulee Dam, Wash., to the estuary at Astoria, Oreg.) and in 1967 (from Priest Rapids Dam, Wash., to the estuary). Dissolved nitrogen was subject to considerable seasonal fluctuation and varied with flow of water over spillways of dams; it was normal (near 100-percent saturation) in the fall and winter when no water was spilled, and high (above 135-percent saturation) in the spring and summer when large volumes of water were spilled. Some saturation levels over large areas were high enough and lasted long enough to be potentially dangerous to salmon (Oncorhynchus spp.) and steelhead trout (Salmo gairdneri). Supersaturation of nitrogen at Priest Rapids Dam lowered the tolerance of juvenile fish to temperature increases, and some showed symptoms of gas bubble disease. Field studies to determine the effects of high levels of dissolved nitrogen on adult salmon and steelhead trout did not provide conclusive results. (Auth.)

12183. Stickney, Alden P. (Bur. of Comm Fisheries Biological Lab., W. Boothbay Harbor, Maine). 1970. FACTORS INFLUENCING THE ATTRACTION OF ATLANTIC HERRING, Clupea harengus harengus, TO ARTIFICIAL LIGHTS. U. S. Dept. of the Interior, U. S. Fish & Wildl. Service Fishery Bull. 68(1): 73-85.

Using artificial lights to attract fish at night is a common and often effective fishing technique. With Atlantic herring the attraction is somewhat uncertain, however, and does not always take place. This paper describes experiments which showed that, in addition to the inherent variability of the fish themselves, certain external conditions can modify the attraction to the light. Attraction was greater at low than at high temperatures, greater with underwater lights than with lights above the surface, and greater when the fish were previously adapted to light than when they were adapted to darkness. Very bright light (illumination 20-600 lux), especially above the surface, tended to repel the fish. Light of intermediate intensity (illumination 1-30 lux) was most effective. The behavioral responses comprised an initial attraction resembling positive phototaxis, followed by apparent disorientation, or confusion. The disorientation may have been due to attempts by the fish to respond with a dorsal light reaction, i. e. to assume postures which would orient their dorsal surface toward the light source even when such postures interfered with normal swimming. (Auth.)

12184. Hansen, David J. (Bur. of Comm. Fisheries Biological Field Station, Gulf Breeze, Florida). 1970. FOOD, GROWTH, MIGRATION, REPRODUCTION, AND ABUNDANCE OF PINFISH, Lagodon rhomboides, AND ATLANTIC CROAKER, Micropogon undulatus, NEAR PENSACOLA, FLORIDA, 1963-65. U. S. Dept. of the Interior, U. S. Fish & Wildl. Service Fishery Bull. 68(1): 135-146.

The abundance, growth, age composition, food, migration, and reproduction of the two species were studied at two locations for each species from August 1963 to December 1965. The materials comprised 22 fish collections at each station, taken in about 500 hours of trawling. The stomach contents of 3, 577 pinfish and 2, 520 Atlantic croakers indicated that pinfish are omnivorous and croakers carnivorous. Principal foods were vegetation, crustaceans, and polychaetes for pinfish and annelids, fish, and arthropods for croakers. Types of food in pinfish stomachs were similar at all sizes and seasons, but the relative amount of each type differed by season and size of fish. Foods in croaker stomachs differed at the two stations but were similar from year to year. The average food volume in the stomachs varied with time of year, location, and fish size. Volumes of food in stomachs of both species decreased when the fish moved from the estuary. Length-frequency distributions can be used to estimate age in both species. Pinfish, and possibly croakers, form annuli on their scales. Growth of pinfish and Atlantic croaker varied from year to year. Some fish of both species had developing gonads in the fall of their first year of life and may spawn. Both species migrate offshore in the fall to spawn. The fry and some adults return to the estuary in the winter and spring. Abundance of pinfish and Atlantic croakers was highest in late spring and early summer. Pinfish at both stations and croakers at one station were less abundant in 1964 than in 1963 or 1965. Yearly differences in abundance of croakers were not large at the other location. (Auth.)

12185. Blackburn, Maurice (Inst. of Marine Resources, Scripps Inst. of Oceanography, Univ. of California, San Diego, California). 1970. CONDITIONS RELATED TO UPWELLING WHICH DETERMINE DISTRIBUTION OF TROPICAL TUNAS OFF WESTERN BAJA CALIFORNIA. U. S. Dept. of the Interior, U. S. Fish & Wildl. Service Fishery Bull. 68(1): 147-176.

Six oceanographic cruises were made off the west coast of southern Baja California in June through November, 1959-66, and some of the results were compared with contemporaneous fishery data on the distribution of yellowfin tuna, Thunnus albacares, and skipjack tuna, Euthynnus pelamis. As a result of the association of red crabs with phytoplankton (surface chlorophyll a) tuna generally occur in the parts of the Baja California region where surface chlorophyll a concentrations are relatively high, provided that surface temperatures are not below 20° C. If the region could be thoroughly and frequently monitored for surface temperature and surface chlorophyll a during a tuna season, areas of probable tuna aggregation could be specified. It may eventually be practicable to do the monitoring from ships, aircraft, or satellites. It would not suffice to monitor surface temperature only. (Auth.)

12186. Bakkala, Richard G. (Bur. of Comm. Fisheries Biological Lab., Seattle, Washington). 1970. SYNOPSIS OF BIOLOGICAL DATA ON THE CHUM SALMON, Oncorhynchus keta (Walbaum) 1792. FAO Fisheries Synopsis No. 41, BCF/S 41, U. S. Dept. of the Interior, U. S. Fish & Wildl. Service Circular 315, 89 p., Illus.

Information presented on the chum salmon includes nomenclature, taxonomy, morphology, distribution, ecology and life history, population dynamics, fishery, and protection and management. (Auth.)

12187. McAllister, D. E. (National Museum of Natural Sciences, Ottawa, Canada). 1970. RARE OR ENDANGERED CANADIAN FISHES. The Canadian Field-Naturalist, 84(1): 5-8.

This paper lists those Canadian species and subspecies which are potentially in danger of extinction in Canada, whose status would deserve further study, and which need public awareness so that no untoward actions will be taken. Included are: Acipenser brevirostrum, Alosa aestivalis, Coregonus alpenae, Coregonus sp., Coregonus johannae, Salvelinus fontinalis timagamiensis, Hybognathus

nuchalis nuchalis, Hybopsis x-punctata, Notropis anogenus, Rhinichthys cataractae subsp., Rhinichthys cataractae smithi, Rhinichthys osculus, Catostomus sp., Moxostoma hubbsi, Stizostedium vitreum glaucum, Cottus confusus, and Gasterosteus sp. (Auth.)

12188. Jerome, William C., Jr., Arthur P. Chesmore, and Charles O. Anderson, Jr. 1969. A STUDY OF THE MARINE RESOURCES OF THE ANNISQUAM RIVER - GLOUCESTER HARBOR COASTAL SYSTEM. Mass. Dept. of Natural Resources, Div. of Marine Fisheries, Monograph Series No. 8, 62 p.

The Annisquam River - Gloucester Harbor Study is the fifth of seven similar studies conducted on the North Shore and one of 14 conducted to date throughout the state. The estuarine research program was initiated in 1963 by the Division of Marine Fisheries, Department of Natural Resources, to provide information needed to develop a sound program of marine fisheries resource management. Data pertaining to type, status, and value of these resources and the factors which affect them, will add substantially to the knowledge of the marine life within the study area. (Introduction)

12189. Clady, Michael D. (Inst. for Fisheries Research, Michigan Dept. of Natural Resources, Ann Arbor, Michigan). 1967. CHANGES IN AN EXPLOITED POPULATION OF THE CISCO, Coregonus artedii LeSueur. Papers of the Michigan Academy of Science, Arts, and Letters, Vol. 52 (1966): 85-99.

Due to a lack of reproduction there was a marked reduction in the spawning population of ciscoes in Birch Lake from 1943 through 1953, accompanied by an increased rate of growth of the survivors. During this time the catch of ciscoes by the gill-net sport fishery declined from about 20,000 fish to nothing. This was followed by a partial recovery of the population by 1965. Growth rates under several population densities showed that growth was largely density independent during the first two years of life but was density dependent thereafter. Growth was not greatly influenced by the age of maturation. An unusually large percentage of females appeared in the spawning run during the population decline, but the sex ratio returned to "normal" when the population stabilized. Possible causes for the unusual sex ratios and population decline are discussed. (Auth.)

12190. Moroz, V. N., and E. G. Spivak (Azov-Black Sea Scientific Research Inst. of Marine Fishery and Oceanography, USSR). 1969. SPAWNING-STOCK CHARACTERISTICS, SPAWNING AND FECUNDITY OF THE PERCH (Perca fluviatilis L.) OF THE DANUBE DELTA WATERS. (Kharakteristika nerestovogo stada, nerest i plodovitost' okunya (Perca fluviatilis L.) del'tovykh vodoemov dunya). Vestnik Zoologii, No. 4: 49-54. Translation from the Russian by Robert M. Howland, Bur. of Sport Fisheries and Wildlife, Narragansett Marine Game Fish Lab., Narragansett, Rhode Island.

The perch (Perca fluviatilis L.) is the most widespread fish in the inland waters of the USSR, having great importance in the local fishing industry. This report is devoted to the ecology of the perch of Danube delta waters. Four hundred perch in all were caught in fish traps and the length and weight of each fish were measured, and also its sex, stage of ripeness, age, nutrition and fecundity were determined. The youngest perch which took part in spawning were three-summer fish with a minimum body length of 11 cm in males and 12 cm in females. Spawning of the perch in the pre-delta bays of the Staro-Stambul'skoe branch in 1967 began during the last days of March at a water temperature of 8-9°. Perch spawning in 1967 lasted until April 20. Judging by the number of spawned out females, it was most intensive during April 4-10 at a water temperature of 9.4-10.7°. Toward the end of spawning the water temperature had climbed to 12.3°. Spawning in the Danube perch occurs once per year. It gathers in schools for spawning and deposits the spawn in long gelatinous strands on rigid vegetation. Individuals of 3-6 years of age participated in spawning; three- and four-year-olds made up the bulk of the spawners, and were in almost equal numbers in the stock. Females predominated in the stock (81%). The length of fish which had taken part in spawning ranged between 10.1 - 26.0 cm, while the weight --- 30-340 g, with an average length of

16.6 cm and average weight of 105 g. The minimal (5,400) number of eggs in the fish was revealed in three-year-old females with a length of 14 cm and weight of 70 g; the maximal (51,570) --- in six-year-old females with a length of 23 cm and weight of 310 g. The average fecundity of the Danube perch is 20,616 eggs. -- Robert M. Howland

12191. Musselius, V. A., and V. I. Laptev. 1967. EXPERIMENTAL APPLICATION OF CHLOROPHOS FOR MOLLUSC CONTROL AT POND FARMS (Opyt primeneniya khlorofosa dlya bor'by mollyuskami v prudovykh khozyaistvakh). Trudy Vsesoyuznogo Nauchnoissledovatel'skogo Instituta Prudovogo Rybnogo Khozyaistva, Voprosy Prudovogo Ryḅovodstva, Vol. 15, "Pishchevaya Promyshlennost", Moscow, 294-298. Translation from the Russian by Robert M. Howland, Bur. of Sport Fisheries and Wildlife, Narragansett Marine Game Fish Lab., Narragansett, Rhode Island.

Freshwater molluscs are the intermediate hosts of the majority of trematodes. In 1964, at the Goryachii Klyuch Fish Hatchery of the Krasnodar Region, a study was conducted by the ichthyopathological laboratory of VNIIPRKh on the molluscicidal effect of chlorophos. It was shown that such weak solutions of chlorophos as 0.1% and 0.25% act lethally. The second stage of the work was clarification of the effect of chlorophos solutions directly on the bottom. The molluscs were treated with a 1% solution of chlorophos. After 24 hours all molluscs had died. With such trials in small earthen ponds, mortality of the molluscs proved to be very high even with such weak solutions as 0.1%, when 92-94% of the molluscs perished, while at a solution concentration of 0.25% the mortality comprised 97-100%. Molluscs buried in the bottom at a depth of 3-5 cm were not killed by application of a 0.5-1% solution to the bed. The systematic application of a combined method of mollusc control (chlorophos, then calcium hypochlorite) is highly effective, permitting the complete destruction of molluscs in ponds, and the installation of special screening on water supply canals limits the penetration of molluscs from the water sources. -- Robert M. Howland

12192. Otte, Elmar. 1969. MYCOBACTERIAL INFECTIONS IN FISHES - MICROORGANISMS AND THEIR REVIEW. (Mykobakterielle Infektionen bei Fischen - Erreger und ihre Beurteilung). Z. Fischerei NF Bd. 17(5): 515-546.

On the basis of Runyon's and his own research Otte divides atypical mycobacteria into four groups: photochromogenic; scotochromogenic; nonchromogenic; rapidly-growing. Fish-pathogenic mycobacteria belong only to group 1 (M. marinum) and group 4 (M. piscium, M. fortuitum). Nonchromogenic mycobacteria to which belong the agents of human tuberculosis can survive in fishes for many months and in this way fish may serve as vectors of this pathogen. Otte collected cultures of mycobacteria isolated from fishes in Europe and United States and determined their characteristics. Methods of study and results are presented in great detail. Pathogenicity of mycobacteria isolated from fishes was tested on guinea pigs, mice, rabbits and chickens. No pathogenicity was observed within six months. Two strains caused localized swelling of lymphatic glands in guinea pigs and mycobacteria were reisolated from lymphatic nodules after 8 weeks. Author concludes that all cultures isolated from fishes belong to three species: 1. M. fortuitum present in fishes in moderate and tropical climatic zones, 2. M. marinum in tropical fishes only, 3. M. spp. belonging to nonchromogenic mycobacteria (Runyon) only in tropical fishes. Mycobacteria are very common saprophytes in nature and therefore fishes are exposed to infection. Mycobacteria causing fish diseases are very seldom capable of infecting people and causing a disease. -- S. F. Snieszko

12193. Kogan, A. V. 1969. DAILY FOOD INTAKE AND INDEX OF FILLING OF THE GUT OF FISH. Problems of Ichthyology, 9(5): 730-732. Translated and produced by Scripta Technica, Inc.

12194. Muzykovskiy, A. M. 1969. SEASONAL ADAPTATION OF Bothriocephalus gowkongensis Yeh, 1955, PARASITIC IN CARP IN POND HUSBANDRIES. Problems of Ichthyology, 9(5): 734-737. Translated and produced by Scripta Technica, Inc.

12195. Heuschmann-Brunner, G. 1970. THE GENUS Aeromonas IN HYDROBIOLOGY. (Die Aeromonaden in der Hydrobiologie). Zeitschrift für Wasser und Abwasser Forschung (WAF) 3, Jahrgang, No. 2, pp. 40-41.

Bacteria belonging to the genus Aeromonas are well known to fishery biologists as fish pathogens but up to this time had little recognition by hydrobiologists. They were first described in Germany by Emmerich and Weibel (1888-89) as fish pathogens causing "furunculosis" in trout and named Bacterium salmonicida (now Aeromonas salmonicida). Zimmermann isolated from tapwater in Chemnitz, Germany "Bacillus punctatus" now known as Aeromonas punctata (A. hydrophila, A. liquefaciens). In 1890-91 Sanarelli isolated from diseased frogs maintained in aquaria receiving spring water a bacterium he named Bacillus hydrophilus fuscus. In 1930 Schaperclaus identified this bacterium as the cause of a widely spread disease of carp which he named "infectious dropsy" (Bauchwassersucht). Snieszko believes that all these bacteria represent one species which he called Aeromonas liquefaciens. On the basis of painstaking research Schubert (1967-1969) divided this genus into a series of species, or types, and in 1966 Caselitz published a monograph on the role of Aeromonas and Pseudomonas as human pathogens. Schubert demonstrated that frogs contain this bacterium in their gut while living in water but not on land. Heuschmann-Brunner reported that as fish pathogens A. hydrophila is more common than A. punctata. Schaperclaus, in 1930, recognized two forms of A. punctata. Recent investigations have shown that reservoir water contains many more Aeromonas than coliforms. Schubert related the quantity of Aeromonas in running water to the degree of organic pollution. In a test stream he counted 21,000 or 33,000 Aeromonas and 500 or 700 coliforms. Effluent from sewers contained 1, 2, and 20 millions of cells of Aeromonas per 1 ml. Further investigations showed that while Aeromonas is not common in feces of people, or warmblooded vertebrates, it grows as a slimy film in sewage-carrying pipes. Therefore the sewage effluent is considered as an important source of Aeromonas in contaminated water. Schubert believes that the main cause of great increase of Aeromonas in relation to coliforms in water is the fact that Aeromonas grows well at 2 to 20°C while coliforms have a much higher optimum temperature. The author concludes that Aeromonas representing the types (or species) hydrophila and punctata play an important role in the self purification of water. They can be employed in the evaluation of organic pollution of water and should be used in the determination of water quality. Some types are opportunistic pathogens of freshwater fishes. A. salmonicida is the only obligate fish pathogen belonging to the genus Aeromonas. -- S. F. Snieszko

12196. Lemanova, N. A., and L. M. Nusenbaum (State Research Inst. for Lake and River Fisheries - GosNIORKh, Leningrad, USSR). 1969. AN INVESTIGATION OF THE SEX ORGANS OF THE RUSSIAN STURGEON (Acipenser guldenstadtii Brandt) PASSED THROUGH THE VOLGOGRAD FISH-LIFT. Problems of Ichthyology, 9(5): 619-626. Translated and produced by Scripta Technica, Inc.

A histological study was made of the sex organs of male and female sturgeon passed through the Volgograd fish-lift during its entire operational period (April-October). It was found that breeding sturgeon should be passed through the fish-lift between April and the middle of July. At that time breeding fishes enter the fish-lift with their gonads either in a state closely approaching maturity or showing signs of degenerative changes in the ovaries. The movement of large numbers of sturgeon which have already spawned is also noted. On the basis of the results of the study some changes may be recommended in the periods for which the fish-lift is operated. Sturgeon should not be passed through until the middle of July when the state of the gonads of breeding fishes entering the fish-lift (stages III-IV of maturity) leave no doubt as to the possibility of effective spawning of the sturgeon the following spring.

12197. Amend, Donald F., and Gary Wedemeyer (Western Fish Disease Lab., Sand Point Naval Air Station, Seattle, Washington). 1970. APPROVED PROCEDURE FOR DETERMINING ABSENCE OF INFECTIOUS PANCREATIC NECROSIS (IPN) VIRUS IN CERTAIN FISH AND FISH PRODUCTS. U. S. Dept. of Interior, Bur. of Sport Fisheries and Wildl., Fish Disease Leaflet No. 27, 4 p.

12198. Shekhanova, I. A., V. S. Bel'makov, and V. I. Lapin (All-Union Research Inst. for Sea Fisheries and Oceanography - VNIRO, Moscow, USSR). 1969. EFFECT OF STRONTIUM-90 — YTTRIUM-90 ON BREEDING LOACH KEPT IN SOLUTIONS OF VARIOUS ACTIVITIES. COMMUNICATION II. Problems of Ichthyology, 9(5): 627-635. Translated and produced by Scripta Technica, Inc.

The effect of strontium-90 and yttrium-90 on the physiological and biochemical characteristics of breeding loach has been investigated under experimental conditions. The fishes were kept in solutions having an activity of 3.11×10^{-10} c/liter, 1.5×10^{-8} c/liter and 1.32×10^{6} c/liter for 110-115 days. The investigation covered the histological structure of the gonads, the spleen and the liver, RNA and DNA content in the ova, hemoglobin content, the number of leukocytes and erythrocytes in the peripheral blood, and the content of fat, protein, glycogen and extractive nitrogen in the muscles, gonads and liver.

12199. Rukhlov, F. N. (Sakhalin Bd. for the Conservation and Reproduction of Fish Stocks and the Regulation of Fishing - Sakhalinrybvod, Yuzhno-Sakhalinsk, USSR). 1969. MATERIALS CHARACTERIZING THE TEXTURE OF BOTTOM MATERIAL IN THE SPAWNING GROUNDS AND REDDS OF THE PINK SALMON [Oncorhynchus gorbuscha (Walbaum)] AND THE AUTUMN CHUM [Oncorhynchus keta (Walbaum)] ON SAKHALIN. Problems of Ichthyology, 9(5): 635-644. Translated and produced by Scripta Technica, Inc.

A detailed description of the bottom material of the spawning grounds is given on the basis of an analysis of extensive material. During the period of observation from 1963 through 1967, 187 samples of bottom material of a total weight of 351, 395 g were taken in the spawning grounds and from the redds of the pink salmon. Similarly, 273 samples with a total weight of 1, 071, 005 g were taken from the spawning grounds and redds of the autumn chum. Gravel and shingle are the predominant size categories in the spawning grounds of the pink salmon and the autumn chum. The average contribution of sand is 14.7%. The mortality of eggs is increased when the proportion of sand in the nest mounds increases. The spawning grounds and redds of the autumn chum contain less sand than those of the pink salmon. On the other hand the bottom material has a higher silt content in the spawning grounds of the autumn chum.

12200. Fedorova, L. S. (Lab. of the Physiology of Fishes, Azov Fisheries Res. Inst. - AzNIIRKh, Rostov-on-Don, USSR). 1969. SOME ASPECTS ON THE NITROGEN METABOLISM OF HATCHERY AND NATURAL YOUNG OF THE PIKE-PERCH [Lucioperca lucioperca (L.)]. Problems of Ichthyology, 9(5): 644-651. Translated and produced by Scripta Technica, Inc.

An account is given of the results of experiments carried out in 1967 at the Bagayevskiy experimental base of AzNIIRKh to determine the viability of pike-perch larvae and young obtained by rearing in a hatchery and by natural spawning. Young pike-perch of corresponding size and weight and stage of development caught in the Don River served as a control. The biological quality of the pike-perch larvae and young was determined by studying the content of protein and of free and combined amino acids in the growing body.

12201. Pirozhnikov, P. L., A. F. Karpevich, A. I. Isayev, and Ye. I. Karpova (Ichthyological Comm. Ministry of Fisheries, USSR). 1969. BIOLOGICAL PRINCIPLES FOR IMPROVING FISHERIES IN INLAND WATERS. Problems of Ichthyology, 9(5): 744-751. Translated and produced by Scripta Technica, Inc.

Fundamental principles and a system of techniques for fisheries improvement are discussed. Improvement of conditions for the natural reproduction of fish, improved biotic conditions of growth, and improved conditions of wintering of fish are described.

12202. U. S. Dept. of the Interior, Division of Fish Hatcheries. 1970. PROPAGATION AND DISTRIBUTION OF FOOD FISHES FOR THE FISCAL YEARS 1967 AND 1968. U. S. Dept. of the Interior, Bur. of Sport Fisheries and Wildlife, Fish and Wildlife Service, Fish Distribution Report No. 3, 63 p.

12203. Birman, I. B. (Kamchatka Dept. of the Pacific Research Inst. for Sea Fisheries and Oceanography - KOTINRO, Petropavlovsk, USSR). 1969. DISTRIBUTION AND GROWTH OF YOUNG PACIFIC SALMON OF THE GENUS Oncorhynchus IN THE SEA. Problems of Ichthyology, 9(5): 651-666. Translated and produced by Scripta Technica, Inc.

It has been established that most of the young salmon descending to the sea remain in coastal areas until the late autumn. The young of different species, especially chum and pink salmon, form concentrations in the same localities, although their food is highly similar and they have practically the same, very high rate of growth. This is an indication of the adequate supply of food for the salmon and of the high biological productivity of coastal waters, which is apparently due to the abundant discharge from the mainland. Given that the feeding grounds are shared in common, the species undoubtedly exert a mutual influence on each other in which the numbers of the pink salmon are decisive, but it cannot always be detected owing to the existence of a two-year cyclicity of fluctuations in numbers specific not merely to the pink salmon, but to other species as well, and occurring (at least at times) in phase.

12204. Vladimirov, V. I. (Inst. of Hydrobiology, Ukrainian Academy of Sciences, Kiev, USSR). 1969. DEPENDENCE OF THE EMBRYONIC DEVELOPMENT AND VIABILITY OF THE CARP ON THE TRACE ELEMENT ZINC. Problems of Ichthyology, 9(5): 687-696. Translated and produced by Scripta Technica, Inc.

Zinc concentrated in very large amounts by carp eggs in the course of oogenesis has an adverse effect on embryonic development and on the viability of the larvae. The addition of zinc sulfate in amounts of 0.05 and 0.5 mg/liter in the early stages of embryogenesis improved the development and viability of the larvae on average. The same effect was also noted when larvae were exposed to the stated doses in the first 10-15 days after hatching, but the positive effect was weaker in this case. The reactions of embryos and larvae to the addition of zinc are largely dependent on zinc content in the eggs.

12205. Vlasenko, M. I. (All-Union Inst. of Experimental Veterinary Surgery, Moscow, USSR). 1969. ULTRAVIOLET RAYS AS A METHOD FOR THE CONTROL OF DISEASES OF FISH EGGS AND YOUNG FISHES. Problems of Ichthyology, 9(5): 697-705. Translated and produced by Scripta Technica, Inc.

The paper sets out the results of laboratory experiments on determination of the sensitivity to UV radiation of the causative agents of byssus (dermatomycosis), constiasis, trichodiniasis, chilodonelliasis and ichthyophthiriasis, and also of the sensitivity of some of the food items of fishes. A calculation is made of the material cost of prophylaxis of some diseases of fish eggs and young using UV rays. It is scientifically demonstrated that the use of UV radiation is effective and economically advantageous in the control of byssus (dermatomycosis) and the essential conditions for the use of this radiation under production conditions are also indicated.

12206. Tsvetkov, V. I. (A. N. Severtsov Inst. of Evolutionary Morphology and Animal Ecology, USSR Academy of Sciences, Moscow, USSR). 1969. THE SENSITIVITY OF SOME FRESHWATER FISHES TO RAPID PRESSURE CHANGE. Problems of Ichthyology, 9(5): 706-711. Translated and produced by Scripta Technica, Inc.

Freshwater fishes, whether physostomous or physoclistic, are highly sensitive to rapid pressure change. The minimum values of pressure change detected by them fall within the range of millimeters - centimeters of a water column. In response to pressure change a behavioral response is to be noted in fishes in the form of a complex of stereotypic reactions. The threshold of perception of pressure change for the pike remains constant at different values of static pressure, i.e., at different depths.

12207. Tyurin, P. V. (State Scientific Research Inst. of Lake and River Fisheries, GosNIORKh, Leningrad, USSR). 1969. CAUSES RESPONSIBLE FOR REDUCED POPULATIONS OF BAYKAL OMUL [Coregonus autumnalis migratorius (Georgi)] AND URGENT MEASURES FOR RESTORING THEM. Problems of Ichthyology, 9(5): 752-764. Translated and produced by Scripta Technica, Inc.

The decrease in the population of the omul of Lake Baykal during the 19th and 20th centuries is calculated as one-third. The main reason for this reduction is the cyclic changes in climate and hydrological conditions in the Lake Baykal basin, which depend on variations in solar activity. The current reduction to a very great extent is also made more severe by additional negative factors resulting from human activity, important among which are the ever-increasing clearing of forests in the Lake Baykal basin, which reduces the flow of water in the spawning rivers, the choking of the rivers as a result of logging operations, and the pollution of the principal omul river, the Selenga, by the impure effluents of numerous industrial plants. An important negative factor is also the commercial fishing, which is done at the wrong time and in the wrong place, and the heavy poaching during the season of spawning migration. All these factors taken together can account for a greater present-day decrease than prevailed in the past. The omul industry in Lake Baykal, as in the northern Caspian Sea, during the next few years should be reorganized and technologically converted from a "marine" to a "river" commercial fishing operation. At the same time the industry should step up its catch in Lake Baykal of sculpins and other fishes which are biotic competitors and antagonists for the omul in the early stages of its development.

12208. Belyy, N. D. (Inst. of Hydrobiology, Academy of Sciences of the Ukranian SSR, Kiev, USSR). 1969. THE BLACK SEA SHAD [Alosa kessleri pontica (Eich.)] IN THE KAKHOVKA RESERVOIR. Problems of Ichthyology, 9(5): 764-770. Translated and produced by Scripta Technica, Inc.

A comparison of the shad caught in the Kakhovka Reservoir with shad caught in the lower reaches of the Dnieper has shown that most of the fish taken in the reservoir had matured at the end of their first year and only a very small proportion of them matured later. In the lower reaches of the Dnieper (Pavlov, 1959), only a very small portion of the shad mature at the end of the first year, with most of them maturing later. The growth rate of the shad in the reservoir and in the lower Dnieper is different. The fish grow faster in the reservoir. The fecundity of the shad from the reservoir was greater than that of the fish from the Dnieper. During the prespawning period the shad in the lower reaches of the Dnieper feed mainly on invertebrate animals, while those in the reservoir feed on fishes (tyulka and young of other species).

12209. Jamsen, G. C., J. R. Ryckman, and F. W. Jamsen. 1970. SALMON, STEELHEAD AND LAKE TROUT SPORT FISHING IN MICHIGAN FROM JANUARY 1 - JUNE 30, 1969. Michigan Dept. of Natural Resources, Research and Development Report No. 198, 3 p. and appendix.

Those licensed to fish for salmon and trout (about half the licensed fishermen in Michigan) are estimated to have spent 2,260,000 days fishing during the first half of 1969. Salmon, steelhead, and lake trout fishing on the Great Lakes and tributary streams amounted to about a quarter of this fishing effort. Salmon fishing on Lake Michigan was concentrated in southwestern Lower Michigan. About 83 percent of the salmon were taken off Berrien, Van Buren, and Allegan counties. Alger, Baraga, and Marquette county waters accounted for 91 percent of the salmon taken from Lake Superior. Steelhead fishing in tributary streams along Lake Michigan was dispersed along the entire lake. The Elk, Little and Big Manistee, Muskegon, Pere Marquette, Platte, and White rivers accounted for 51 percent of the catch and 62 percent of the tributary stream effort. The Two Hearted, Ontonagon, and Ravine rivers accounted for 35 percent of the steelhead catch and 39 percent of the tributary stream effort for Lake Superior streams. Two areas on the Great Lakes (Grand Traverse Bay and Keweenaw Bay) presently provide good sport fishing for the entire year. They also provide significant contributions to the catch and effort on the Great Lakes. In this survey period,

78 percent of the lake trout caught in Lake Michigan were from Grand Traverse Bay. About 18 percent of the 132,000 angler-days of effort on Lake Michigan occurred here. Keweenaw Bay accounted for 51 percent of the total lake trout catch on Lake Superior during the first half of 1969. The effort at this location amounted to approximately 25 percent of the 103,000 angler-days recorded for Lake Superior. (Authors results)

12210. Schoettger, Richard A., and Gerald E. Svendsen (Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisconsin). 1970. EFFECTS OF ANTIMYCIN A ON TISSUE RESPIRATION OF RAINBOW TROUT AND CHANNEL CATFISH. U. S. Dept. of Interior, Bur. of Sport Fisheries and Wildlife, Investigations in Fish Control No. 39, 10 p.

Effects of antimycin A on respiration of liver, kidney, brain, and gill of rainbow trout and channel catfish were measured in vivo and in vitro. In vitro, brain was most resistant to the toxicant, followed by liver and kidney. Brain was more sensitive in vivo than in vitro; liver and kidney were less sensitive in vivo than in vitro. Untreated trout tissues had higher rates of respiration than did catfish tissues. Liver had the greatest oxygen consumption of all tissues. (Authors)

12211. Lennon, Robert E., and Bernard L. Berger (Bur. of Sport Fisheries and Wildlife, Fish Control Lab., La Crosse, Wisconsin). 1970. A RESUME ON FIELD APPLICATIONS OF ANTIMYCIN A TO CONTROL FISH. U. S. Dept. of Interior, Bur. of Sport Fisheries and Wildlife, Investigations in Fish Control No. 40, 19 p.

Antimycin A, a fish toxicant, has had more than 50 applications to control fish in the field. It has been used for partial reclamations, and as a general or selective toxicant. It is effective against fish in fresh and marine waters, in acid and alkaline waters, in cold and warm waters, and in flowing and static waters. The formulations contribute no color or odor to water and do not repel fish. The toxic action, respiratory inhibition, is irreversible in most fishes. Fish-killing concentrations are harmless to most aquatic invertebrates and to higher vertebrates. Highlights of the field applications are presented. (Authors)

12212. Jenkins, Robert M. (National Reservoir Res. Program, Bur. of Sport Fisheries and Wildlife, Fayetteville, Arkansas). 1970. THE INFLUENCE OF ENGINEERING DESIGN AND OPERATION AND OTHER ENVIRONMENTAL FACTORS ON RESERVOIR FISHERY RESOURCES. Journal of the American Water Resources Assn., Water Resources Bull. 6(1): 110-119.

The apparent effect of selected reservoir environmental variables -- including surface area, mean depth, outlet depth, thermocline depth, water level fluctuation, storage ratio, shore development, total dissolved solids, growing season and age of reservoir -- on fish standing crop in 140 large impoundments has been explored through partial correlation and multiple regression analyses. The sample was partitioned into 25 subsamples based on reservoir use type, water exchange rate, thermocline formation and water chemistry. Fish standing crops were estimated by summer rotenone sampling of coves or open water areas enclosed by blockoff net. Logarithmic partial correlation revealed highly significant (0.01 confidence level) positive effects of outlet depth, shore development and dissolved solids on total standing crop in the entire sample. At the 0.20 confidence level, the crop of all sport fishes is positively influenced by outlet depth, storage ratio, and shore development and negatively by mean depth. In 54 hydropower reservoirs with a stable thermocline, positive effects of increased storage ratio and dissolved solids on total crop are evident at the 0.05 confidence interval. Increase in thermocline depth has a negative effect. In 25 hydropower reservoirs without a stable thermocline, clupeid (shad) crop is negatively correlated with surface area, mean depth and fluctuation. Reservoirs with a thermocline have higher standing crops than those without. At the species or species group level, partial correlation of nine environmental variables at the 0.05 confidence interval reveals: Positive effect of surface area on pike and pickerel; negative effect of mean depth on longnose gar, buffalofishes, white crappie and total sport fish crop; positive

effect of outlet depth on largemouth bass, catfishes, total sport fish crop and buffalofishes; a negative effect of water level fluctuation on pike and pickerel, redear sunfish and gizzard shad; a positive relationship between storage ratio and channel catfish and bullheads and a negative one with flathead catfish and suckers; a positive effect of total dissolved solids on black and white basses, catfishes, gizzard shad, carpsuckers and carp. A morphoedaphic expression, total dissolved solids divided by mean depth, provides a useful index to reservoir fish production. The relationship is curvilinear, with maximum crops expected at index values of 5 to 30. The index accounts for 62 percent of the variability in hydropower storage reservoir crops. Several multivariable regressions have been derived for predictive purposes. Examples are included, with R values of 35 to 60. (Auth.)

12213. Vanicek, C. David, Robert H. Kramer, and Donald R. Franklin (Dept. of Biological Sciences, Sacramento State College, Sacramento, California). 1970. DISTRIBUTION OF GREEN RIVER FISHES IN UTAH AND COLORADO FOLLOWING CLOSURE OF FLAMING GORGE DAM. The Southwestern Naturalist 14(3): 297-315.

Flaming Gorge Dam on the Green River, Utah was closed in November, 1962. Studies of fish populations from the dam downstream to Ouray, Utah, were conducted from July, 1963, to October, 1966. The objectives of these studies were: 1) to study changes in river environment associated with closure of the dam; 2) to determine species composition, distribution, and abundance of fishes in the study section; and 3) to compare 1963-1966 distribution of fishes with that reported in pre-impoundment collections. A total of 24,040 fish consisting of 9 indigenous and 12 exotic species was taken in 667 collections by electrofishing gear, gill nets, seines, and fry gear. Flaming Gorge Dam has caused a major change in the ecology of the downstream Green River by alteration of seasonal flows and water-temperature patterns as far as the mouth of the Yampa River, 65 miles below the dam. As a result, native fish populations, particularly in the first 26 miles below the dam, have been largely replaced by introduced rainbow trout (Salmo gairdneri). Below the Yampa River mouth, fish populations were similar to those reported during the pre-impoundment years. During years of high summer discharge from the dam with resultant lower water temperatures (1964 and 1966), no reproduction of any native fishes was found in the Green River above the mouth of the Yampa River. (Authors)

12214. Wolf, Ken, and P. E. Vestergard Jørgensen (Bur. of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Kearneysville, West Virginia). 1970. SALMONID VIRUSES: DOUBLE INFECTION OF RTG-2 CELLS WITH EGTVED AND INFECTIOUS PANCREATIC NECROSIS VIRUSES. Archiv für die gesamte Virusforschung No. 29, 337-342.

Egtved and infectious pancreatic necrosis (IPN) viruses were applied at high multiplicity alone and in combination to RTG-2 cells in liquid medium. Procedures were used which selectively suppressed one or the other virus, and the yeilds were determined after 64 hours at 15°C. The viruses showed an increase of 280 to 450 times the immediate post-adsorption level. Plaques of IPN and Egtved viruses showed some differences which can be helpful in distinguishing between the two agents. Detailed methods and results are given. (Authors summ.)

12215. Matida, Yoshihiro, and Hiroshi Kumada. 1969. DISTRIBUTION OF MERCURY IN WATER, BOTTOM MUD AND AQUATIC ORGANISMS OF MINAMATA BAY, THE RIVER AGANO AND OTHER WATER BODIES IN JAPAN. Bull. Freshw. Fish. Res. Lab., Tokyo, 19(2): 73-93.

Distributions of mercury and other heavy metals were examined in water, mud and aquatic organisms in Minamata Bay, the River Agano and other waters in Japan. Of the heavy metals, only mercury was very high in Minamata Bay and the River Agano where Minamata disease occurred. The distribution of mercury in Minamata Bay indicated that the origin of mercury was the Minamata factory of Shin-Nippon-Chisso Company. The content of total and organic mercury in aquatic organisms suggested that monitoring, background survey and study of the mechanism of accumulation of these substances are desirable. (Authors summ.)

12216. Kennedy, Harry D., Lafayette L. Eller, and David F. Walsh (Bur. of Sport Fisheries and Wildlife, Fish-Pesticide Res. Lab., Columbia, Missouri). 1970. CHRONIC EFFECTS OF METHOXYCHLOR ON BLUEGILLS AND AQUATIC INVERTEBRATES. U. S. Dept. of Interior, Bur. of Sport Fisheries and Wildlife Technical Paper No. 53, 18 p., illus.

Bluegills (average weight 7 grams, average fork length 73 mm) were exposed to methoxychlor at concentrations of 0, 0.01, and 0.04 ppm in ponds for 13 weeks in late summer. Fish losses were small and not attributable to methoxychlor exposure. There were no significant differences in fish growth in the three pairs of ponds. Pathologic changes occurred in tissues and organs, primarily in livers and circulatory systems. Precipitated materials were observed in major blood vessels of gills and hearts 24 hours after treatment. This material coalesced, became multivacuolated, was conspicuous in most large blood vessels of every organ during the first week after treatment, persisted through day 28, and disappeared by day 56. Methoxychlor uptake by the fish in 0.04-ppm-treated ponds was rapid, 21 ppm by day 3; the insecticide was stored in whole body tissues through day 28 and metabolized or excreted by day 56. Significantly higher numbers of aquatic insects were sampled in treated ponds than in untreated, and insect numbers at high-treatment ponds were significantly higher than at low-treatment ponds. Chironomids were dominant and significantly increased after the 0.04-ppm treatment. Chironomids comprised 74 percent of samples from high-treatment ponds, but only 43 and 42 percent respectively from untreated and low-treatment ponds. Mayflies of the family Baetidae were less common, and the family Heptageniidae was scarce in the high-treatment ponds. Other insects in untreated and low-treatment ponds were similar in population densities. Methoxychlor residues were not detectable in pond-bottom mud samples. (Authors)

12217. Beardsley, Grant L., Jr., and William J. Richards (Bur. of Commercial Fisheries, Tropical Atlantic Biological Lab., Miami, Florida). 1970. SIZE, SEASONAL ABUNDANCE, AND LENGTH-WEIGHT RELATION OF SOME SCOMBRID FISHES FROM SOUTHEAST FLORIDA. U. S. Dept. of Interior, Fish and Wildlife Service Special Scientific Report - Fisheries No. 595, 6 p.

Seven species of scombrid fishes were sampled for length and weight at a taxidermy firm for 1 year (September 1967 - September 1968). These data yielded information on size distribution and seasonal abundance of the species off south Florida. In addition, length-weight relations and calculated weights at given lengths are presented. (Authors)

12218. Yokote, Masa. 1969. OBSERVATION ON EGGS SPAWNED UPON THE ARTIFICIAL WEEDS SET IN THE SAGAMI RESERVOIR. Bull. Freshw. Fish. Res. Lab., Tokyo, 19(2): 113-119.

Since many impounded waters of Japan are located in mountainous areas, they have steep shores and also have remarkably changeable water levels. Therefore, they often lack the shallow areas and littoral plants which are so common in natural lakes. Such environments bear ill effects on the lives of fish species inhabiting the reservoirs. One of the main problems is that there are few areas for spawning and fry production. As an aid to fish spawning, artificial weeds which consisted of bundles of tape-shaped polyethylene-film were set for fish nesting in Lake Sagami during the crucian carp spawning season. The wet weight of periphyton on the artificial leaves and number of eggs spawned on them were kept under observation. The floating shelters of artificial weeds were set for three and one-half months. After this period, the floating ability was decreased in 15% of all of the film because of the substances deposited on the surfaces. Other weeds were set for two months as artificial spawning nests. During this period, spawning was distinctly observed twice. More eggs were counted on the middle bundles of the shelters and on the base part of each leaf. Adherence of eggs to the film was fairly tight. The average number of eggs attached to the artificial weeds was 0.2-1.3 per 1 cm^2 and their hatching rate averaged 71.9%. After hatching the fry were identified as crucian carp. Artificial fish nests of polyethylene film can be considered highly useful as spawning shelters in a reservoir. (Auth. synopsis)

12219. Kimura, Sekio, and Masahiro Matsushima. 1969. STUDIES ON THE EFFECTS OF SEVERAL AGRICULTURAL CONTROL CHEMICALS ON THE SPAWNING OF WILD GOLDFISH (Carassius carassius cuvieri T. et S.) AND THE HATCHING OF THE EGGS. Bull. Freshw. Fish. Res. Lab., Tokyo, 19(2): 121-135.

This study was carried out to examine the effects of several agricultural control chemicals at permissible concentrations on the reproduction of wild goldfish because the application season of these chemicals coincides with the spawning season of warmwater fishes including wild goldfish. Adult wild goldfish just before spawning and the eggs spawned by control fish were used as test organisms. The tolerance limit of carp for Dieldrin is higher than that of wild goldfish. A similar tendency was confirmed for γ-BHC tolerance limits for Dipterex, Ethyl parathion and PCP. In adult wild goldfish just before spawning, no fish died at concentrations of 0.1 x 48 hr.-TLm for 4 to 5 days. However, at concentrations higher than 0.5 x 48 hr.-TLm, more than half of the chemicals tested resulted in uncoordinated swimming and death. Adult wild goldfish seem to be more susceptible to organophosphates as compared with their fry, since more than fifty percent of them died in 48 hours at the 48 hr.-TLm of the same chemicals for their fry. Adult wild goldfish were found to be more resistant to chlorinated hydrocarbons than their fry. The spawning ability of fish exposed to Dipterex at concentrations higher than 0.5 x 48 hr.-TLm seemed affected. The influence of this chemical on spawning is equivocal at 0.1 x 48 hr.-TLm. In most cases, adult wild goldfish could not tolerate the 48 hr.-TLm concentrations of the chemicals. The spawning ability of surviving fish did not seem affected as long as the period of exposure to the chemicals was less than 5 to 12 hours. No deleterious effects were observed regarding hatching percentage and deformed fry from the eggs of the fish exposed to the chemicals. None of the chemicals tested affected the hatching of the eggs spawned by control fish at 0.1 x 48 hr.-TLm. The hatching rate was not good in the solutions of Ethyl parathion and PCP of 48 hr.-TLm. Dieldrin did not affect the eggs at 48 hr.-TLm. The difference between the tolerances of the eggs and the fry varied with chemicals. The chemicals tested did not affect adult wild goldfish, their spawning ability and eggs at concentrations of 0.1 x 48 hr.-TLm for carp fry. Deleterious effects were observed at concentrations higher than 0.5 x 48 hr.-TLm. Long term studies are required to understand the effect of chlorinated hydrocarbons which readily accumulate in fish and remain toxic for a long time in the water. (Authors synopsis)

12220. Kawatsu, Hiroshi. 1969. STUDIES ON THE ANEMIA OF FISH - III. AN EXAMPLE OF MACROCYTIC ANEMIA FOUND IN BROOK TROUT, Salvelinus fontinalis. Bull. Freshw. Fish. Res. Lab., Tokyo, 19(2): 161-167.

Macrocytic anemia was found in four 3-year-old brook trout in an examination conducted on May 27, 1969. After 4 months, they were reexamined for the purpose of tracing the progress of the hematological variations. Hematological data of the diseased fish were as follows. Erythrocyte count: 902,000 (in May) – 773,000 (in Sep.); M.C.V.: 450-470μ^3; M.C.D.: 18.9-19.5μ; M.C.H.: 111 x 10^{-9} mg per cell; M.C.H.C.: 24.7. In the smear preparation, anisocytosis, fragmentation of erythrocyte nucleus and the enucleate erythrocytes were observed. In addition to the morphological abnormalities of erythrocytes, hypersegmentation of neutrophils was found. These characteristics of the blood picture resemble that of pernicious anemia in humans, but the cause of the present anemia remains unexplained. (Auth. summ.)

12221. Chittenden, M. E., Jr., and J. R. Westman (Rutgers Univ., New Brunswick, New Jersey). 1970. EFFECTS OF THERMAL AND OTHER FORMS OF POLLUTION ON SOME ANADROMOUS FISHES. PART I. Water Resources Res. Inst., Rutgers Univ. of New Jersey, 91 p.; Selected Water Resources Abstracts, 3(12): p. 41.

This is an account of laboratory experiments regarding the vulnerability to some forms of pollution upon young American shad and striped bass, which are anadromous fish passing the estuaries of a number of Eastern rivers. The experiments covered (1) salinity, low temperature, tolerance, and avoidance reactions and oxygen requirements of the shad, (2) effects of Mn (OH)2 settling time on the

Winkler dissolved oxygen determination in brackish water, and (3) effect of handling upon the oxygen requirements of the striped bass in fresh and salt waters and (4) oxygen levels at death for the striped bass. -- Whipple

12222. Alabaster, John S. (Water Pollution Res. Lab., Stevenage, England). 1969. EVALUATING RISKS OF PESTICIDES TO FISH. Proceedings 5th British Insecticide and Fungicide Conference, pp. 370-377; Selected Water Resources Abstracts, 3(13): p. 40, 1970.

General requirements for measuring the toxicity of pesticides to fish are outlined, together with the standard test developed by the British Ministry of Agriculture, Fisheries and Food. Tests are discussed in relation to their usefulness for screening purposes and for predicting the effect of pesticides on fisheries under field conditions. Experiments on the uptake of organo-chlorine pesticides by fish are described. -- Sjolseth and Katz

12223. Abedi, Z. H., and P. M. Scott (Dept. of National Health and Welfare, Ottawa Food and Drug Research Lab., Ontario, Canada). 1969. DETECTION OF TOXICITY OF AFLATOXINS, STERIGMATOCYSTIN, AND OTHER FUNGAL TOXINS BY LETHAL ACTION ON ZEBRA FISH LARVAE. Journal of the Assn. of Official Analytic Chemists, Vol. 52, pp. 963-969; Selected Water Resources Abstracts, 3(13): p. 49, 1970.

The effects of 13 fungal toxins (and one derivative) on the larvae of zebra fish, Brachydanio rerio (Hamilton-Buchanan), were investigated. The most toxic were sterigmatocystin, gliotoxin, and aflatoxin B_1, which were lethal at concentrations of less than 1 µg/ml. Aflatoxins B_2, G_1, and G_2, stemphone, diacetoxyscirpenol, ochratoxin A, aspertoxin, and patulin also showed toxicity to the larvae, while aflatoxin B_1 hemiacetal, penicillic acid, and griseofulvin were non-toxic at the levels tested. Specific morphological effects were noted with sterigmatocystin, aflatoxins, and stemphone. The usefulness of zebra fish larvae as bioassay test organisms for fungal toxins is discussed. -- Sjolseth

12224. Toews, Daniel P., and C. P. Hickman, Jr. (Dept. of Zoology, Alberta Univ., Edmonton, Alberta, Canada). 1969. THE EFFECT OF CYCLING TEMPERATURES ON ELECTROLYTE BALANCE IN SKELETAL MUSCLE AND PLASMA OF RAINBOW TROUT, Salmo gairdneri. Comp. Biochem. Physiol., Vol. 29, pp. 905-918; Selected Water Resources Abstracts, 3(14): p. 31, 1970.

Rainbow trout, Salmo gairdneri, (1-1/2 yr. old) were acclimated to a daily temperature cycle ranging from 8 to 18 deg C. Control fish were maintained at constant temperatures which coincided with the sample temperatures of the cycling fish. Sodium, potassium, chloride and water were measured in the plasma and muscle of all the fish. In most cases the plasma ion levels in the cycling fish did not exceed those levels of the control fish which were held at low temperatures (8-10 deg C). There was a highly significant inverse relationship between the muscle potassium and the muscle sodium levels in the cycling fish. Control fish did not exhibit this inverse relationship. Evidence from plasma and tissue concentrations of electrolytes in both the cycling and control trout indicated that cycling trout acclimated to the lowest temperatures of the cycles. -- Sjolseth and Katz

12225. Cruz, J. Amorim Machado (Faculty of Sciences, Université de Porto, Portugal). 1969. ON AN EPIZOOTIC FOCUS OF GOITER IN THE RAINBOW TROUT (Salmo irideus Gib.) POPULATIONS. [Sur un Focus Épizootique de Goître dans des Populations de Truite Arc-en-ciel (Salmo irideus Gib.)]. Estudos c Divulgação Técnica. Secretaria de Estado da Agricultura Direcção-geral dos Serviços Florestais e Aquicolas, 11 p.

In the spring of 1966, an epizootic focus of goiter in the rainbow trout population of Fonte Santa fish pond was diagnosed, the first time in Portugal. The etiology of this epizootic focus is not absolutely clear but it is thought that it could be connected with a probable dificiency of iodine in the water brought about by a completely abnormal rainfall. The author feels that it could be advantageous to be especially attentive to goiter prophylaxis in the salmonid populations in abnormally rainy years. (Auth. resume)

12226. Li, M. F., G. S. Traxler, and L. M. Langille (Fish. Res. Bd. of Canada, Halifax Lab., Nova Scotia, Canada). 1970. TOXIC EFFECT OF ELEMENTAL PHOSPHORUS ON L-CELLS CULTIVATED IN SUSPENSION. Canad. J. Zool., 48(1): 133-136; Selected Water Resources Abstracts, 3(14): p. 31.

Recent mass mortalities of herring, Clupea harengus, occurring in Placentia Bay, Newfoundland, have been attributed to seawater pollution by elemental phosphorus. The effects of elemental phosphorus upon cell replication and cellular morphology were tested on L-cells grown in spinner culture. The cell replication was completely inhibited by the presence of elemental phosphorus in the culture medium at 1.25 mg/l. At 0.31 mg/l, 74% inhibition of the cell replication was observed. A calculated correlation coefficient between the percentage inhibition and the phosphorus concentration was valid at the 1% level. The phosphorus significantly altered the cellular morphology. The affected cells showed ballonization, loss of stain-binding capacity, disintegration of cytoplasm, enlarged nuclei with vacuolated nucleoli, and formation of multiple nucleated giant cells. A possible sequence of the changes was discussed. -- Sjolseth

12227. Spitzer, Kenneth W., Daniel E. Marvin, Jr., and Alan G. Heath (Virginia Polytechnic Inst., Blacksburg, Virginia). 1969. THE EFFECT OF TEMPERATURE ON THE RESPIRATORY AND CARDIAC RESPONSE OF THE BLUEGILL SUNFISH TO HYPOXIA. Comp. Biochem. Physiol., Vol. 30, pp. 83-90; Selected Water Resources Abstracts, 3(14): p. 31, 1970.

Bluegill sunfish were acclimated to 30 plus or minus 1.25 plus or minus 1, and 13 plus or minus 1°C, and then subjected to gradually induced environmental hypoxia. Routine oxygen consumption, ventiliation rate and heart rate were measured at varying oxygen concentrations. Fish at 25 and 13°C showed varying degrees of oxygen independence. Those at 30°C exhibit oxygen dependence. During hypoxia, ventilation rate increases in both 13 and 25°C fish but failed to do so at 30°C. Bradycardia occurred in all acclimation temperatures. The results indicate that the environmental temperature of the bluegill significantly affects its response to gradual hypoxia. -- Sjolseth and Katz

12228. Houston, A. H., and Jane A. Madden (Dept. of Biology, Marquette Univ., Milwaukee, Wisconsin). 1968. ENVIRONMENTAL TEMPERATURE AND PLASMA ELECTROLYTE REGULATION IN THE CARP, Cyprinus carpio. Nature, Vol. 217, pp. 969-970; Selected Water Resources Abstracts, 3(14): p. 32, 1970.

During a study of systemic aspects of the thermoacclimatory process, the relation between temperature and electrolyte-regulatory ability in a typical freshwater eurytherm, the common carp, was studied. The fish were acclimatized to 4°, 17°, 27°, and 33° for intervals of not less than 3 weeks. Both regulations and its precision were modified by temperature. Plasma sodium concentrations were a maximum at 27° with a mean concentration of about 9-10 millimoles/l greater than those at 4° or 33°. By contrast, chloride concentrations increased from a mean of 115.6 millimoles/l at 4°C to 137.0 at 33°. Coupled with this the precision of chloride regulation diminished markedly at higher temperatures. Phosphate concentration increased sharply between 4° and 17° and then diminished slowly. Plasma calcium also increased with temperature from 1.94 millimoles/l at 4° to 2.54 at 33°. Potassium and magnesium concentrations displayed no consistent variations. The ratio of plasma chloride to total cations increased with temperature, suggesting that the concentration of some anionic species, presumably HCO_3^-, increases at lower temperatures. A fall in plasma osmolarity at increased temperatures, with a pronounced drop between 27° and 33° is suggested. In contrast, the sum of all cations plus chloride steadily rose with temperature. -- Novotny

12229. Bryuzgin, V. I. (Inst. of Hydrobiology, Academy of Sciences, Ukrainian SSR, Kiev, USSR). 1970. THE APPLICATION OF EMPIRICAL SCALES FOR THE STUDY OF FISH GROWTH. (Primenenie empiricheskikh shkal dlya izucheniya rosta ryb). Gidrobiologicheskii Zhurnal, 6(1): 96-104. In Russian.

12230. Haas, Robert C. 1970. THE EFFECTS OF LAMPREY LARVICIDE ON THE BOTTOM FAUNA AND PERIPHYTON OF THE CHOCOLAY RIVER, MARQUETTE COUNTY, MICHIGAN. Michigan Dept. of Natural Resources Research and Development Report No. 200, 66 p.

The Chocolay River, Marquette County, Michigan, was selected to study the effects of lamprey larvicide on the bottom fauna and periphyton. In 1965, two stream treatments with TFM (3-trifluormethyl-4-nitrophenol) were made. The concentration of larvicide was 1 ppm during the first treatment and 4 ppm during the second. Bottom fauna and periphyton samples were collected before and after each treatment to analyze the effects of the larvicide. In order to evaluate the effect of the larvicide, twelve taxa of bottom fauna in riffle areas and eight taxa in pool areas were utilized. Percent change in abundance of each taxa did not reveal a larvicide effect from the 1 ppm treatment. However, all taxa, except two, decreased in numbers in the experimental riffle area from the 4 ppm treatment. The eight taxa in the experimental pool area also decreased in numbers during the 4 ppm treatment. These results indicated that the second larvicide treatment did cause a decline in bottom fauna. Numbers of benthic organisms in the experimental and control areas were statistically compared. In the experimental riffle areas, the number of benthic organisms was significantly lowered after the second treatment. No other significant differences for the bottom fauna in the riffles were found except between the experimental and control number before the second treatment. This difference was probably a function of the high variation in the control. Pool bottom fauna areas exhibited high variation unrelated to TFM and most statistical comparisons showed the experimental and control to be significantly different in numbers of benthos during most sampling periods. These differences make a judgment on larvicide effects impossible for the experimental pool benthos. The only positive result of statistical analyses strongly indicated that the 4 ppm larvicide treatment caused a decline in riffle bottom fauna abundance, but not the pool abundance. During 1964 and 1965, periphyton standing crop was measured at two experimental and two control areas to test effects of the larvicide. A statistical analysis comparing periphyton weights revealed that standing crops were significantly different between years, areas, and within areas on different dates. Periphyton weights immediately before and after each treatment were compared to further test the effects of the larvicide treatments. No significant differences were found suggesting that the larvicide did not affect the standing crop of periphyton. (Auth. summ.)

12231. Love, R. Malcolm. 1970. THE CHEMICAL BIOLOGY OF FISHES. Academic Press, 547 pp. (n. d.) 140s, Paul Dando (reviewer); New Scientist, 46(695): p. 34; Commercial Fisheries Abstracts, 23(7): p. 1.

The first quarter of this book is a review of the chemical constituents of fish tissues, including an account of some of the sampling errors commonly made in the analysis of chemical compounds of fish, the difficulties generated by cell and tissue heterogeneity in fish muscle, and the nearly impossible task of sampling fish in a naturally rested or unstressed condition. Later sections deal with changes in the chemical components of fishes during their life cycle, including the major changes in tissues during maturity and spawning; differences in tissue constituents, including an account of intraspecific variation and of ecological effects on the behavior and composition of fish; and the effects of both natural and forced periods of starvation on fishes' chemical composition. The author emphasizes throughout the book that results obtained with one species do not necessarily apply to other species. The second half of the book contains indexes of published material reporting work that has been done on the chemical components of fish. This material is listed under both the fish species and the chemical. -- L. Baldwin

12232. U. S. Dept. of the Interior, Bur. of Comm. Fisheries. 1970. FISHERY MOTION PICTURES. U. S. Dept. of Interior, Bur. of Commercial Fisheries - Fishery Leaflet No. 629, 28 p., Illus.

12233. Patton, Stuart, G. F. Crozier, and A. A. Benson (Div. of Food Science, Pennsylvania State Univ., University Park, Pennsylvania). 1970. SERUM LIPIDS AND THE DEATH OF SPAWNING PACIFIC SALMON. Nature, 225(5234): 754-755; Commercial Fisheries Abstracts, 23(7): p. 24.

Blood serum lipids of pink salmon, Oncorhynchus gorbuscha, caught at two points in the spawning route were compared. A large triglyceride component consistently appeared in individual as well as pooled serum samples of both male and female salmon caught just off the coast. Little or no triglyceride appeared in similar serum samples of salmon caught some 60 mi. upstream on the spawning grounds. Apparently sex is an unimportant factor in the serum triglycerides and the total serum lipids. Only one or two of the serum lipid samples showed even faint evidence of diglycerides and none showed evidence of monoglycerides. Cholesterol levels of the ocean-caught and the stream-caught fish were fairly similar -- the former averaged 54 percent esterified and 46 percent free cholesterol, the latter averaged 60 percent esterified and 40 percent free cholesterol. Largely due to two fish in the ocean group that had unusually high levels of free fatty acids (44 and 52 mg./100 ml.), the serum free fatty acids of the ocean fish averaged somewhat higher than those of the spawning-ground fish. The authors conclude that, since spawning streams could not possibly supply millions of mature fish with an adequate food supply during their migration, the weight loss and serum-lipid depression of spawning fish indicate that they are starving. -- L. Baldwin

12234. Ivankov, V. N. (Marine Biology Section of the Fareastern Branch of SO, Academy of Sciences of the USSR, Vladivostok, USSR). 1970. VARIABILITY AND INTRASPECIFIC DIFFERENTIATION OF Oncorhynchus keta. (Izmenchivost' i vnutrividovaya differentsiatsiya kety). Gidrobiologicheskii Zhurnal, 6(2): 106-112. In Russian. (Auth. conclusions translated by R. Howland)

The summer and autumn races of the chum salmon differ only by rate of growth and consequently by body dimensions during the spawning migration. Such morphological differences (and even more expressed) have been established in local stocks within a race. Considerable transgression is noted in absolute fecundity in the seasonal races. Populations of the autumn chum with the largest body dimensions (British Columbia, Southern Kurile Islands) are characterized by the same fecundity as certain populations of the summer chum (Western Kamchatka, Sakhalin Island, Amur River), and even less (Anadyr' River). Ripeness of the gonads of different populations of the autumn chum salmon upon approach to the mouths of rivers depends on the extent of the migrations of the fish through the river to the spawning sites. The races of chum salmon do not differ by the state of body nourishment. In regard to basic biological indices — absolute fecundity and body dimensions — five types of local stocks are distinguishable. (Auth. conclusion)

12235. Kuz'mina, V. V. (Lab. of Fish Physiology IBVV, Academy of Sciences of the USSR, Borok; Lab. of the Evolution of Endocrine Functions IEFiB, Academy of Sciences of the USSR, Leningrad, USSR). 1970. GLYCEMIA LEVEL IN FRESHWATER TELEOSTS. (Uroven'glikemii u presnovodnykh kostistykh ryb). Gidrobiologicheskii Zhurnal, 6(2): 88-96. In Russian. (Auth. conclusions translated by R. Howland)

In the majority of fishes investigated the glycemia level varies considerably in norm. However, the results obtained for the carp indicate the fact that in fish as well as in higher vertebrates the maintenance of glycemia at a constant level is possible. A specific correlation exists in freshwater teleosts between the glycemia level and the biological peculiarities of the species. For experimental work on carbohydrate metabolism in fish it is expedient to employ specially-bred, physiologically-homogeneous material. (Auth. conclusion)

12236. Dawson, C. E. (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1964. A BIBLIOGRAPHY OF ANOMALIES OF FISHES. Gulf Res. Reports, 1(6): 308-399.

12237. Kudrinskaya, O. I. (Inst. of Hydrobiology, Academy of Sciences, Ukrainian SSR, Kiev, USSR). 1970. ENERGY BALANCE AND PROVISION OF THE LARVAE OF THE PIKEPERCH WITH FOOD. (Energeticheskii balans i obespechennost' pishchei lichinok sudaka). Gidrobiologicheskii Zhurnal, 6(1): 5-15.

Estimation of provision with food of pikeperch (L. lucioperca) larvae in the Olshanka River (Kremenchug Reservoir) in 1966 and 1967 is given according to energy balance, which is based on calculation of the food requirement of the larva and its satisfaction under the concrete conditions of the basin. Applying the mathematical formula $\frac{n_{min}}{n} = e^{-\frac{r_{sr}}{r_{min}}}$, an amount of larvae is calculated which will not get the minimum rations to compensate for their metabolic expenditures. (Auth. summ.)

12238. Tatarko, K. I. (Inst. of Hydrobiology AN USSR, Kiev, USSR). 1970. SENSITIVITY OF THE POND CARP TO HIGH TEMPERATURE AT EARLY STAGES OF POST-EMBRYONAL DEVELOPMENT. (Chuvstvitel'nost' prudovogo karpa k vysokoi temperature na rannikh etapakh postembrional'nogo razvitiya). Gidrobiologicheskii Zhurnal, 6(2): 102-105. In Russian. Conclusions (Author's, translated by R. Howland).

The pond carp at early stages of post-embryonal development (A-G according to V. V. Vasnetsov) is very resistant to a temperature of 36°. It becomes highly sensitive to a temperature of 38° only at the earliest period of post-embryonal development (stages A-D_1); the larvae are most sensitive at stages A and D_1. At a later period (stages D_2-G), sensitivity of the carp to temperature is not high; moreover, it diminishes gradually with age. (Auth. conclusion)

12239. Shkorbatov, G. L., Zh. A. Gurevich, L. G. Deineko (Khar'kov State Univ., USSR). 1970. TOWARD THE QUESTION ABOUT MANIFESTATIONS OF TEMPERATURE ADAPTATION IN FISH ON THE PROTEIN LEVEL OF ORGANIZATION. (K voprosu o proyavleniyakh temperaturnoi adaptatsii u ryb na belkovom urovne organizatsii). Gidrobiologicheskii Zhurnal, 6(2): 97-101. In Russian. Conclusions (Authors', translated by R. Howland).

Change in the enzymatic activity of actomyosin of three fish species from different habitats was investigated. Similar results were obtained, which permit evaluation of the observed differences in the enzymatic activity of actomyosin of "warm" and "cold" fish of one species as a manifestation of temperature adaptation of the organism. The minimal period for the formation of stable adaptational changes, by selected test, specified by change in the temperature conditions of the existence of the fish, is 17-18 days. This period for the enzyme in question in the fish species studied consists of three phases, which differ by the level of ATP-ase activity of actomyosin and by the temperature optimum of the particular enzymatic reaction. Criteria which indicate completion of the adaptational process are: a) the appearance of authentic differences in the activity of actomyosin of the fish of one species, which have lived at the same temperature and adapt to different temperatures (guppies, carp: beginning $R > 0.1$; end $R < 0.05$); b) loss of authentic differences in the protein activity of fish of one species, which have lived at different temperatures and adapted to the same temperature (perch from the Northern Don and Lake Liman: beginning $R < 0.05$; end $R > 0.1$); c) stabilization of the temperature optimum of the enzymatic reaction of actomyosin in the 19° zone in any direction of adaptation. Temperature adaptations at the protein level in fish evidently are not connected with significant changes in the structure of the enzyme; they have a reversible character and enter into the chain of homeostatic reactions of the organism in response to change in environmental conditions. (Authors conclusion)

12240. Caillouet, Charles W., Jr. (Dept. of Zoology and Entomology, Iowa State Univ., Ames, Iowa). 1970. EXPERIMENT ON EFFECTS OF EXERCISE AND HYPOXIA ON FISH METABOLISM. Turtox News, 48(1): 26-27.

12241. Applegate, Vernon C., and Harry D. Van Meter (Bur. of Comm. Fisheries Biological Station, Sandusky, Ohio). 1970. A BRIEF HISTORY OF COMMERCIAL FISHING IN LAKE ERIE. U. S. Dept. of Interior, U. S. Fish Wildl. Serv. Fish. Leaflet No. 630, 28 p., illus.

Salient features of the development of the industry from about 1815 to 1968, changes in fishing gears and methods, changes in the kinds and abundance of fishes caught, and the attendant effects of disappearing species on the stability of the fishery are described. The history and present status of the walleye, yellow perch, and eight other fishes, still taken in commercial quantities, are presented in more detail and are considered in the context of their effect on the current moribund state of the U. S. fishery. Past and present contributions of Lake Erie's tributaries and northerly connecting waters to the fishery are outlined briefly. The "outlook" for the fishery under present conditions of selective overfishing for high-value species, excessive pollution, ineffective and uncoordinated regulation, and antiquated methods of handling, processing, and marketing fish are discussed, and possible solutions to these problems are suggested. (Authors)

12242. Ridgway, George J., Harold O. Hodgins, and George W. Klontz (Bur. of Comm. Fisheries Biological Lab., Boothbay Harbor, Maine). 1966. THE IMMUNE RESPONSE IN TELEOSTS. Phylogeny of Immunity, published by Univ. of Florida Press, pp. 199-207.

It is evident that the teleosts are at a relatively advanced stage in the evolutionary development of the immune response. Most of the immune responses known in mammals and birds also exist in teleosts. There is some evidence for deficiencies of a quantitative rather than a qualitative nature. However, these are possibly due in part to the lower body temperature. Some of the quantitative deficiencies are probably characteristic of the species investigated. Immunologists recognize that some mammals are good precipitin producers, others are not; and extreme cases exist like the agammaglobulinemic humans who produce no humoral antibodies. Therefore, we should not consider a few goldfish or trout as representative of all the teleosts. This highly variable group of animals seems to the authors to abound with possibilities for research, both on the macroevolutionary aspects of comparative immunology, and on the genetic, microevolutionary aspects. Perhaps in the poor fish there will be found some of the answers to the most profound questions of biology and medicine. (Authors conclusion)

12243. Merrett, N. R. (East African Marine Fisheries Research Organization, Zanzibar, Africa). 1970. GONAD DEVELOPMENT IN BILLFISH (ISTIOPHORIDAE) FROM THE INDIAN OCEAN. J. Zool., London, 160(3): 355-370.

Gonad examinations were made on billfish caught during a tuna longline survey in the equatorial western Indian Ocean. The species considered were Istiophorus platypterus, Tetrapterus audax, Tetrapterus angustirostris, Makaira nigricans, and Makaira indica. The morphology of the urino-genital system is described for all species. It was found to be similar in all except T. angustirostris in which the gonads are Y-shaped rather than bilaterally symmetrical. The histology of the gonads is described, and the changes within the testis and ovary are traced throughout the spermatogenic and oogenic cycles. These are shown to be similar in all species examined. (Auth.)

12244. Tarter, Donald C. (Biology Dept. Kentucky Southern College, Louisville, Kentucky). 1969. SOME PARASITES OF THE WESTERN BLACKNOSE DACE, Rhinichthys atratulus meleagris Agassiz, IN DOE RUN, MEADE COUNTY, KENTUCKY. Trans. Amer. Microsc. Soc., 88(3): 425-430.

Examination of 1,474 blacknose dace, Rhinichthys atratulus meleagris Agassiz, from three stations in the upper 3.1 miles of Doe Run, Meade County, Kentucky, yielded data on two different parasites. The integuments of western blacknose dace were infested with Neascus sp., an ectoparasitic metacercaria, while Rhabdochona sp., a parasitic nematode, was distributed throughout the stomach and intestine. No direct harmful effects from the two parasites were observed. (Auth.)

12245. Smith, Albert C. (Div. of Science, Univ. of Hawaii, Hilo; and Dept. of Population and Environmental Biology, Univ. of California, Irvine, California). 1970. ELECTROPHORETIC, SOLUBILITY AND THERMOSTABILITY DIFFERENCES IN PROTEINS OF EYE LENS NUCLEI FROM TWO CLOSELY RELATED FISH SPECIES, THE YELLOWFIN TUNA AND THE BIGEYE TUNA. Comp. Biochem. Physiol., 33(1): 1-14.

Electrophoretic separation of protein from lens nuclei of yellowfin and bigeye tunas produced species-specific patterns. Certain of these proteins from the yellowfin and bigeye had identical electrophoretic mobilities but differed in solubility. In both tuna species, proteins from heated extracts revealed an increasing thermostability with increasing electrophoretic mobility and molecular weight. Proteins of bigeye, however, were more heat-stable than those of yellowfin. The electrophoretic, solubility and thermostability data indicate that the low molecular weight nuclear lens proteins are less alike than those of high molecular weight in related species. (Auth.)

12246. Richards, Brent D., and Paul O. Fromm (Dept. of Physiology, Michigan State Univ., East Lansing, Michigan). 1970. SODIUM UPTAKE BY ISOLATED-PERFUSED GILLS OF RAINBOW TROUT (Salmo gairdneri). Comp. Biochem. Physiol., 33(2): 303-310.

Individual gill arches of rainbow trout (Salmo gairdneri) were surgically prepared and perfused (in vitro) with various solutions, using a constant pressure perfusion apparatus. When gills were perfused with Ringer solution with a normal or slightly elevated sodium concentration, there was a small but significant loss of sodium into the bathing medium. Perfusion with Ringer solution in which the sodium concentration was less than normal, always resulted in a net uptake of sodium. The sodium concentration of the perfusion fluid, and epinephrine, appear to control the rate of sodium uptake by the gill. The effects of ouabain, cyanide and iodoacetate indicate that sodium uptake is ATP-dependent and that the ATP is produced via aerobic metabolism. The rate of sodium uptake was found to be generally independent of the rate and pattern of fluid flow through the gill. (Authors)

12247. Servizi, J. A., D. W. Martens, and R. W. Gordon. 1970. EFFECTS OF DECAYING BARK ON INCUBATING SALMON EGGS. International Pacific Salmon Fisheries Commission Progress Report No. 24, 28 p.

The effect of bark contamination on salmon spawning grounds was assessed in laboratory tests on sockeye salmon (Oncorhynchus nerka) eggs and alevins. Bioassays showed that chemical toxicity of materials leached from bark of Douglas fir, Lodgepole pine, Engelmann spruce and Alpine fir was not a factor influencing survival under the conditions tested. However, abundant growths of Sphaerotilus occurred on bark during initial stages of decay, causing severe mortalities among sockeye eggs and alevins owing to suffocation. In gravel-filled incubation boxes, contamination of gravel with bark caused significant reductions in survival from egg to fry at bark concentrations of 10% by volume, but 1% bark concentrations did not influence survival. Mortalities were attributed to blockage of intragravel water flow by bark particles. The oxygen demand of decaying bark was found to be relatively constant with time during the 683-day study. Calculations based on oxygen demand of bark indicated the amount of oxygen which would remain for egg incubation in natural redds at various temperatures and levels of bark contamination. Possible effects of various oxygen concentrations on size and emergence timing of fry were discussed and limiting amounts of bark recommended. (Authors)

12248. Stunkard, Horace W. (American Museum of Natural History, New York, New York). 1969. Lepocreadium areolatum (Linton, 1900) N. COMB., SYN. Distomum areolatum Rudolphi of Linton, 1900 (TREMATODA: DIGENEA). Trans. Amer. Microsc. Soc., 88(1): 79-84.

Distomum areolatum Rudolphi of Linton, 1900, is redescribed and assigned to the genus Lepocreadium Stossich, 1904. (Auth.)

12249. Templeton, R. G. (The Yorkshire Ouse and Hull River Authority, Leeds 1, England). 1970. THE MOVEMENT AND GROWTH OF HATCHERY REARED TROUT INTRODUCED INTO THE RIVER NIDD, YORKSHIRE. The Yorkshire Ouse and Hull River Authority Special Report, 1970.

4,250 hatchery reared brown trout, from 6 to 12 inches, were tagged and introduced into the River Nidd, Yorkshire. Thirteen batches were stocked over 32 miles from December 1968 to March 1969. Returns were made by anglers during the season from April 1st to September 30th. There was a total rate of return of 7.6% including reports of tagged fish replaced after capture. Ninety-one percent of the total number of recaptures had been recorded by the end of May. A small percentage move considerable distances. The greatest distance moved was 57 miles downstream. There is some evidence that large fish stocked a few weeks before the opening of the season are more catchable. There were insufficient returns to draw any general conclusions about growth rates. In a separate experiment batches of tagged trout were retained in ponds and weed grown channel at the hatchery. The tag loss rate of dorsal tags from November to August was around 25%. Restocking the River Nidd with hatchery reared brown trout should be re-examined for a more efficient approach. (Auth.)

12250. Burrows, Roger E., and Harry H. Chenoweth (Bur. of Sport Fisheries and Wildlife, Salmon-Cultural Lab., Longview, Washington). 1970. THE RECTANGULAR CIRCULATING REARING POND. Progr. Fish Cult., 32(2): 67-80.

A rectangular circulating rearing pond with a center wall and turning vanes can direct and control the water circulation induced by 2 jet headers driving against opposite end walls. The rectangular shape reduced construction costs and, when combined with turning vanes, develops an excellent flow pattern. The length of the pond may be either 50 or 75 feet, the depth either 30 or 36 inches. The width is constant at 17 feet. The flow pattern is vertical, moving from the inlet headers parallel to the outside wall and toward the center wall in a rectangular, horizontal path, but gradually spiralling toward the center. The water leaves the pond through 2 horizontal bottom screens located on opposite sides and at opposite ends of the center wall. Water velocities are adjustable to be compatible with fish size and inflows, and range from 150 to 720 g. p. m., dependent on pond length and depth and velocity desired. Minor variations and alterations are possible to meet local conditions, but major alterations in the basic design are not recommended. In operational efficiency, the rectangular circulating pond is superior to the raceway, the circular pond, and the Foster-Lucas pond when carrying capacity, disease inhibition, food distribution, and cleaning efficiency are the criteria for comparison. Using a fifth criterion, viability of fingerlings, the rectangular circulating pond produces fall chinook fingerlings whose survival rate to adults is more than 50% greater than that of otherwise comparable fingerlings reared in raceways. Forced exercise produces fish with higher stamina and greater viability. (Authors)

12251. Brauhn, James L., and Robert N. Ray (Bur. of Sport Fisheries and Wildlife, Fish-Pesticide Res. Lab., Columbia, Missouri). 1970. BACTERIA ASSOCIATED WITH REDEAR SUNFISH MORTALITY. Progr. Fish Cult., 32(2): p. 80.

During the period 1965-68, mortality of the pond-reared redear sunfish (Lepomis microlophus) at 2 hatcheries ranged from 1 to 98%. Because Staphylococcus epidermis and S. epidermis, together with Aeromonas liquifaciens, were isolated from dying redear sunfish and largemouth bass (Micropterus salmoides), respectively, a virus was suspected. Intraperitoneal injections of viable S. epidermis cells into channel catfish (Ictalurus punctatus), bluegills (L. macrochirus), redear sunfish, and largemouth bass had negative results.

12252. Poon, Derek C., and A. Kenneth Johnson (Dept. of Fisheries and Wildlife, Oregon State Univ., Corvallis, Oregon). 1970. THE EFFECT OF DELAYED FERTILIZATION ON TRANSPORTED SALMON EGGS. Progr. Fish Cult. 32(2): 81-84.

Ninety-two percent survival of pink salmon (Oncorhynchus gorbuscha) eggs

shipped from Alaska to Oregon was achieved by storing unfertilized eggs and sperm in separate containers; survival of a second group of eggs fertilized before shipment was only 40%. Although unfertilized eggs are less subject to mortality from handling than newly fertilized eggs, mortality of stored eggs may result from lowered fertility unless certain precautions are taken. Air space is not essential for storage of ova, but air is necessary for sperm. High fertility can be maintained up to 20 hours by storing eggs and sperm in iced, insulated containers. Dilution of the stored milt with water just before fertilization of eggs also increases fertility. (Authors)

12253. Dupree, Harry K., O. L. Green, and Kermit E. Sneed (Bur. of Sport Fisheries and Wildlife, Southeastern Fish Cultural Lab., Marion, Alabama). 1970. THE GROWTH AND SURVIVAL OF FINGERLING CHANNEL CATFISH FED COMPLETE AND INCOMPLETE FEEDS IN PONDS AND TROUGHS. Progr. Fish Cult. 32(2): 85-92.

Three feeds, 2 dietarily complete and 1 dietarily incomplete, were fed to fingerling channel catfish (Ictalurus punctatus) in ponds and in troughs. In ponds, no difference in gain, feed conversion, or survival could be attributed to any feed. In troughs, more fish died when fed one complete feed and the incomplete feed than when fed another complete feed, but there was no weight gain difference on either complete feed. Weight gain of the fish on the incomplete feed was significantly lower than weight gain of the fish on either complete feed. After fortification of the incomplete feed with vitamins or beef liver, deaths were about the same as those of fish fed the best complete feed. Gain after beef liver supplementation approached that of fish on the best complete feed. Nutrient quality of feeds appears to be of little importance if natural feeds are available in amounts sufficient to balance the diet. (Authors)

12254. Adelman, Ira R., and Lloyd L. Smith (Dept. of Entomology, Fisheries, and Wildlife, Univ. of Minnesota, St. Paul, Minnesota). 1970. EFFECT OF OXYGEN ON GROWTH AND FOOD CONVERSION EFFICIENCY OF NORTHERN PIKE. Progr. Fish Cult., 32(2): 93-96.

Two experiments were run for 42 and 48 days to determine the effect of dissolved oxygen concentration on growth, food consumption, and food conversion efficiency of juvenile northern pike (Esox lucius L.). Growth and food consumption rates decreased gradually with the reduction in oxygen concentrations from 7.20 to 3 ppm, and decreased more rapidly at lower levels. Food conversion efficiency was constant from 7.20 to 2.91 ppm, and then decreased abruptly below 2.91 ppm. Gradual decrease in growth rate with decreasing oxygen levels to about 3 ppm was caused by decline in food consumption, and the extreme decrease below 3 ppm was caused by decreased food consumption and decreased food conversion efficiency. (Authors)

12255. Snow, J. R., and James I. Maxwell (Bur. of Sport Fisheries and Wildlife, Marion National Fish Hatchery, Marion, Alabama). 1970. OREGON MOIST PELLET AS A PRODUCTION RATION FOR LARGEMOUTH BASS. Progr. Fish Cult., 32(2): 100-101.

Seven rearing ponds (1.6 acres) at the Marion, Alabama, National Fish Hatchery were used during trials to evaluate the Oregon moist pellet as a production ration for 25,414 largemouth bass (Micropterus salmoides) weighing 5,383 lb. The ponds showed some variation in percent survival and weight harvested. Contributing to this variation were such factors as disease, background of fish stocked, water chemistry of individual rearing ponds, and effect of management practices required for each pond. Nevertheless, the bass fed the Oregon moist pellet were more consistent as to yeild, feed conversion, survival, and rate of gain than the bass receiving other diets. In 12 out of 12 pond trials, fingerlings fed the Oregon moist pellet were reared to 6 to 9 inches. No adverse effects on the fish were observed in 344 days.

12256. Konar, S. K. (Dept. of Zoology, Kalyani Univ., Kalyani, Nadia, W. B., India). 1970. NICOTINE AS A FISH POISON. Progr. Fish Cult., 32(2): 103-104.

Several concentrations of water-soluble plant-alkaloid nicotine (1-methyl-2-3-pyridyl pyrrolidine) were tested, at room temperature (18.9° to 23.9°C), against 2 freshwater fish species and 2 aquatic insect species. The test fishes were more sensitive to nicotine than the test insects, but quick surfacing and rapid and total recovery of the fish indicated that nicotine may be highly promising for salvaging fish from reservoirs.

12257. Fitz, Richard B. (Fish and Wildlife Branch, Tennessee Valley Authority, Norris, Tennessee). 1970. POTENTIAL OF ELECTROFISHING GEAR FOR FRESHWATER COMMERCIAL FISH HARVEST. Progr. Fish Cult., 32(2): 105-109.

A small, highly mobile boom shocker was tested on Watts Bar Reservoir, Tennessee, as a commercial fishing tool. Testing periods were spread out randomly over a 1-year period. Catch for the year, representing 64 hours of electrofishing, was 4,320 lb of commercial fish worth $210. at the current local wholesale market prices. Straight-line projections of quarterly data show that net yearly profits would be somewhat above those now realized by east Tennessee fishermen using conventional gear such as snaglines and gill nets. (Auth.)

12258. Ashley, Laurence M. (Bur. of Sport Fisheries and Wildlife, Western Fish Nutrition Lab., Cook, Washington). 1970. ACTION OF IRON SALTS IN SOLUTION ON GOLDFISH. Progr. Fish Cult., 32(2): p. 109.

In his "Iron Salts in Ichthyopathology, A Histological and Histochemical Experimental Contribution" (Publications of Institute of Zoology, University of Porto, Portugal, 1969), J. Amorim Machado-Cruz described the response of 13- to 28-gram goldfish (Carassius auratus) exposed to ferrous or ferric chlorides or sulfates dissolved in distilled water.

12259. Klima, Edward F. (Bur. of Comm. Fisheries, Pascagoula, Mississippi). 1970. A COMPARISON OF FLASHED WHITE AND INFRARED ILLUMINATION FOR PHOTOGRAPHIC OBSERVATION OF NOCTURNAL BEHAVIOR OF SHRIMP. Progr. Fish Cult., 32(2): 110-112.

The suitability of flashed white and infrared light for nocturnally photographing the active pink shrimp, Penaeus duorarum, was studied. Flashed white light of 0.2-millisecond duration, pulsed at 1/2-hour intervals throughout the night, appeared satisfactory for determining magnitude and duration of shrimp activity levels. The nocturnal activity of shrimp may be affected by exposure to infrared light. (Auth.)

12260. Allen, John L., and Paul D. Harman (Bur. of Sport Fisheries and Wildlife, Southeastern Fish Control Lab., Warm Springs, Georgia). 1970. CONTROL OF pH IN MS-222 ANESTHETIC SOLUTIONS. Progr. Fish Cult., 32(2): p. 100.

MS-222, an acid salt, lowers the pH of water solutions in proportion to its concentration and the hardness of the water. Solutions containing 4 concentrations of MS-222 and 3 hardnesses were buffered to near neutral pH by adding 2 ppm of sodium bicarbonate for each part per million of MS-222. (Authors)

12261. Larimore, R. Weldon (Illinois Natural History Survey, Urbana, Illinois). 1970. TWO SHALLOW-WATER BOTTOM SAMPLERS. Progr. Fish Cult., 32(2): 116-119.

Two bottom samplers, basically consisting of modified half cylinders on long handles, are described and evaluated. Although these grabs are useful in sampling soft bottoms in quiet water up to 10 ft. deep, the strong jaws and handles make them especially valuable in working firm, irregular bottoms in swift water. (Auth.)

12262. Johnson, Sven I., and James L. Squire, Jr. (Bur. of Sport Fisheries and Wildlife, Tiburon Marine Lab., Tiburon, California). 1970. SURFACE CURRENTS AS DETERMINED BY DRIFT CARD RELEASES ON THE CONTINENTAL SHELF OFF THE NORTHWESTERN UNITED STATES. U. S. Dept. of the Interior, Bur. of Sport Fisheries and Wildlife Technical Paper No. 48, 12 p.

Measurements of surface current drift off Oregon and Washington were made from March 1964 through February 1966 with plastic drift cards dropped from Coast Guard planes at selected points. Results show pronounced surface drift to the north in winter and to the south in spring, each drift associated with a strong wind flow. From April to late in the fall the drift is variable; during this period drift cards were returned showing surface drift opposite to wind flow, indicating that wind direction and intensity are not necessarily indications of surface current flow. (Authors)

12263. Houser, Alfred, and Horace E. Bryant (Bur. of Sport Fisheries and Wildlife, South Central Reservoir Investigations, Fayetteville, Arkansas). 1970. AGE, GROWTH, SEX COMPOSITION, AND MATURITY OF WHITE BASS IN BULL SHOALS RESERVOIR. U. S. Dept. of the Interior, Bur. of Sport Fisheries and Wildlife Technical Paper No. 49, 11 p.

White bass (Roccus chrysops, Rafinesque) in Bull Shoals Reservoir were studied from October 1963 through January 1966 to determine age, growth, sex composition, and maturity. Average calculated total lengths of females at the end of each year of life through 6 years were 193, 338, 400, 427, 441, and 457 mm and of males 185, 320, 344, 397, 413, and 443 mm. Growth in Bull Shoals is similar to that in other southern waters. Growth was faster but lifespan shorter than in northern waters. Females outnumbered males 1.7 to 1. All 2-year-old white bass were sexually mature. Most males but only a few females mature at 1 year. Large fluctuations in year-class strength were evident. The 1961 and 1963 year classes were much stronger than those of 1962 and 1964. (Authors)

12264. Mullan, James W., and Richard L. Applegate (Bur. of Sport Fisheries and Wildlife, South Central Reservoir Investigations, Fayetteville, Arkansas). 1970. FOOD HABITS OF FIVE CENTRARCHIDS DURING FILLING OF BEAVER RESERVOIR, 1965-66. U. S. Dept. of the Interior, Bur. of Sport Fisheries and Wildlife Technical Paper No. 50, 16 p.

Stomach contents were examined from 1,886 largemouth bass, 334 spotted bass, 1,689 bluegills, 918 green sunfish, and 579 longear sunfish from shoreline areas of Beaver Reservoir during two of the first three years of filling. Quality and quantity of food by seasons and size groups (<50, 50-100, 101-200, and >200 millimeters in total length (TL) is related to abundance of the principal forage. Greatest volumes of food were found in winter-spring months when water level rose and inundated soils for the first time; terrestrial earthworms, insects, slugs, spiders, centipedes, sowbugs, and worm snakes were major foods in these seasons, particularly of fish 101-200 mm TL. Except for the larger bass, fish had smallest volumes in stomachs in late fall, following a decline that began when water levels stabilized in June. In early summer, largemouth and spotted bass more than 50 mm TL fed mostly on young-of-year threadfin and gizzard shad, and sunfishes fed on aquatic insects. As summer progressed to fall, the larger bass had more crayfish, sunfish, black bass, and bullheads in their diets, and the smaller bass shifted to aquatic insects, microcrustaceans, and terrestrial insects. Minor use of fish as food by larger sunfishes also declined; bluegills depended more on terrestrial insects, crustaceans, snails, bryozoans, algae, and plant detritus; green sunfish more on aquatic insects, crayfish, and algae; and longear sunfish more on aquatic insects, algae, and plant detritus. (Authors)

12265. Pyle, Earl A., and Olber L. Ray (Bur. of Sport Fisheries and Wildlife, Bowden National Fish Hatchery, Elkins, West Virginia). 1970. USE OF POPULATION NUMBERS TO ESTIMATE FEED ALLOWANCES FOR TROUT. Progr. Fish Cult., 32(2): 97-100.

Length increase and population numbers are used to calculate feed allowances for brook (Salvelinus fontinalis), brown (Salmo trutta), and rainbow trout (S. gairdneri). A table and examples are included. (Authors)

12266. Bryant, Horace E., and David I. Morais (Bur. of Sport Fisheries and Wildlife, South Central Reservoir Investigations, Fayetteville, Arkansas). 1970. IDENTIFICATION OF INGESTED GIZZARD SHAD AND THREADFIN SHAD BY GIZZARD DIMENSIONS. U. S. Dept. of the Interior, Bur. of Sport Fisheries and Wildlife Technical Paper No. 51, 5 p.

Gizzard shad (Dorosoma cepedianum) and threadfin shad (D. petenense) remains in predator stomachs can be specifically identified by differences in their gizzard dimensions. A separation line equidistant from the gizzard length-weight means of the two species in terms of standard deviations is presented, as well as a regression of total fish length on gizzard width. Fairly reliable identification is possible when gizzard widths are greater than 4 millimeters. (Authors)

12267. Mullan, James W., David I. Morais, and Richard L. Applegate (Bur. of Sport Fisheries and Wildlife, South Central Reservoir Investigations, Fayetteville, Arkansas). 1970. THERMAL, OXYGEN AND CONDUCTANCE CHARACTERISTICS OF A NEW AND AN OLD OZARK RESERVOIR. U. S. Dept. of the Interior, Bur. of Sport Fisheries and Wildlife Technical Paper No. 52, 29 p.

Thermal, oxygen, and conductance characteristics are described for two impoundments of the White River in Arkansas and Missouri, from 1963 to 1967. Bull Shoals filled in 1952 and is 18,400 hectares at top of power pool; Upstream Beaver Reservoir began filling in 1964 and reached 10,700 hectares in 1966 (94% of power pool area). Both reservoirs have warm monomictic cycles. Warming of hypolimnetic waters in Beaver lagged behind that of Bull Shoals owing to epilimnetic turbidity. Annual heat budgets for Bull Shoals were consistently higher than those of Beaver Reservoir; when adjusted for mean depth, heat budgets did not differ significantly from those of natural lakes. Peak heat content occurred in years of lowest surface temperatures. Successive annual increases in water transparency, depth of thermocline formation, and oxygen content of underlying waters were evident in new Beaver Reservoir. Oxygen distribution graded from clinograde through orthograde in both reservoirs. Irregular patterns of oxygen distribution were related to the manner in which winter-stored water was depleted or retained. Comparison with other waters for nearly all measurements related to biological productivity suggest an oligomesotrophic classification. Average conductance of Beaver Reservoir was inversely correlated with inflow volume; in Bull Shoals Reservoir, highest values were in periods of high inflow and water exchange. (Authors)

12268. Moss, S. A., and W. N. McFarland (Biology Dept., Southeastern Mass. Univ., Massachusetts). 1970. THE INFLUENCE OF DISSOLVED OXYGEN AND CARBON DIOXIDE ON FISH SCHOOLING BEHAVIOR. Marine Biology, 5(2): 100-107.

Slow reduction of dissolved oxygen concentrations or slowly increased carbon dioxide (reduced pH) did not cause measurable changes in the density, nearest neighbor orientation, or the swimming speed of experimental schools of the northern anchovy Engraulis mordax, until near-lethal levels were reached. Rapid reductions of oxygen or pH, however, caused significant increases in average swimming velocity. Positive reactions were correlated to rapid reductions of no more than 0.55 mg O_2/l or 0.25 pH units. These responses are related to the hypothesis that metabolic reductions of environmental dissolved oxygen and/or pH may influence the internal structure and behavior of fish schools. (Authors)

12269. McKinney, James M., and Arthur D. Bradford (Pennsylvania Fish Commission, Benner Spring Fish Research Station, Bellefonte, Pennsylvania). 1970. MEASURING RESPIRATION RATES OF Myxosoma cerebralis SPORES. Progr. Fish Cult., 32(2): p. 120.

The spores of Myxosoma cerebralis were successfully concentrated by homogenizing the cranial area of infected trout, then centrifuging the homogenate. Respiring elements other than spores were destroyed by a modified Tyndallization procedure.

12270. Savvaitova, K. A., and V. A. Maksimov (Dept. of Ichthyology, Moscow State Univ. and Kamchatka Branch of the Pacific Scientific Res. Inst. of Fisheries and Oceanography (KOTINRO), USSR). 1969. AGE AND GROWTH OF THE KAMCHATKAN ANADROMOUS TROUT (Salmo penshinensis Pallas)AND THE KAMCHATKAN RIVER TROUT (Salmo mykiss Walbaum). Problems of Ichthyology, American Fisheries Society, 9(4): 536-546.

For the first time the age composition, number of sclerites, growth rate and nature of the allometric growth of the anadromous Kamchatkan trout and fresh-water mykiss have been analyzed in detail in the literature. Equations for allometric growth are given for individual populations and also literature data on age and growth of the American steelhead trout and for Salmo clarkii. On the basis of material investigated it is concluded that the Kamchatkan trout and the mykiss belong to one species, S. mykiss Walbaum and that there exist great differences between populations of the fresh-water mykiss and finally that there is a similarity between the Kamchatkan and the American trout.

12271. Khalturina, M. I., and D. K. Khalturin (State Res. Inst. for Lake and River Fisheries - GosNIORKh, Northwestern Bd. for the Conservation and Reproduction of Fish Stocks, Leningrad, USSR). 1969. STRUCTURE OF THE PRESENT-DAY SPAWNING POPULATION OF THE NEVA SALMON (Salmo salar L.) Problems of Ichthyology, American Fisheries Society, 9(4): 490-498.

A comparative examination is made of data concerning the age, size-weight and sexual composition of the spawning population of the Neva salmon, and also of the proportion in it between increment and residue. Observations made in 1960 and 1966 have shown that the concentration of hatchery production to be noted in all the age groups of the salmon is accompanied by an increase in the number of breeding fishes 3+ and 4+ years old. By comparison with data of the pre-war years (Svetovidova, 1941) characterizing the structure of the natural spawning population of the salmon, the marine period in the life of the fishes before the spawning migration is now shortened and there is a reduction in the mean weight of fishes in identical age groups. The weight of tagged ("hatchery") female and male salmon is less than the weight of untagged ("wild" and "hatchery-reared") salmon. Salmon of natural origin in the Neva River are characterized by a better growth rate than hatchery salmon. Reduction in the natural qualities of the salmon is undesirable but, unfortunately, appropriate attention is not devoted to aspects of selection in piscicultural work.

12272. Ivanova, M. N. (Inst. of Biology of Inland Waters, USSR Academy of Sciences, Borok Yaroslav Oblast, USSR). 1969. THE BEHAVIOR OF PREDATORY FISH DURING FEEDING. Problems of Ichthyology, American Fisheries Society, 9(4): 574-577.

The paper shows that predatory fishes, depending on hunting conditions and in response to shifting behavior on the part of the prey, either turn to feeding on other food organisms or change their method of hunting. Mature pike and pike-perch, as a rule, are solitary predators which feed mainly during the hours of darkness. In particular seasons when the abundance of food organisms is high, pike and pike-perch may temporarily hunt in schools. This is accompanied by a change in the feeding cycle of the predators.

12273. Belyayev, V. V., and G. V. Zuyev (Inst. of the Biology of Southern Seas, Academy of Sciences of the Ukrainian SSR, Sevastopol', USSR). 1969. HYDRODYNAMIC HYPOTHESIS OF SCHOOL FORMATION IN FISHES. Problems of Ichthyology, American Fisheries Society, 9(4): 578-584.

A hydrodynamic hypothesis is developed for the swimming of fishes in schools based on the perception and mutual utilization by fish in a school of the hydrodynamic pressure fields generated by them to create optimum conditions of movement of the school as a whole. When the fish in a school are distributed in a certain way relative to one another, a certain hydrodynamic effect is created which consists essentially in a favorable interaction between circulation and eddy tracks accompanied by increased stability of a system of periodic tracks in the school. In the final case this leads to reduced resistance.

12274. Erman, Ye. Z. (All-Union Scientific Res. Inst. of Pond Fishery (VNIPRKh). Rybnyi Dmitrov Raion, Moscow Oblast, USSR). 1969. THE NITROGEN-SAVING EFFECT OF CARBOHYDRATES IN THE CARP. Problems of Ichthyology, American Fisheries Society, 9(4): 615-617.

When carbohydrate food (13.8% starch) was added to the diet of carp, the quantity of nitrogen eliminated by the fish declined 52-59%, indicating that a nitrogen-saving effect is produced in fish by carbohydrates. The nitrogen-saving effect of carbohydrates is seen when both plant and animal food is used as the principal protein component. The amount of nitrogen eliminated by the carp did not depend on the content of this element in the diet. It was 2.9% greater in fish which had fasted for 15 days than in fish which had fasted for three days. The nitrogen-saving effect of carbohydrate in fishes indicates the universal character of the physiological processes responsible for this phenomenon which are characteristic both of warm-blooded and of cold-blooded animals.

12275. Cairns, John, Jr., John S. Crossman, and Kenneth L. Dickson (Biology Dept., Virginia Polytechnic Inst., Blacksburg, Virginia). 1970. THE BIOLOGICAL RECOVERY OF THE CLINCH RIVER FOLLOWING A FLY ASH POND SPILL. Reprint for the 25th Purdue Industrial Waste Conf., May 5-7, 1970. Published in the Purdue Univ. Engineering Bull., 13 p. plus illus.

From this preliminary survey, conducted in the summer and fall of 1969, involving sampling for bottom fauna and fish, the following tentative conclusions seem justified: 1) Aquatic communities of "bottom fauna" that were completely eliminated below the power plant at Station 7 had recovered to a point where the number of different kinds of organisms found at this station were approximately the same as in upstream control stations unaffected by the spill. However, the densities of individuals of these species were still less than the control stations indicating that full recovery had not occurred. 2) Populations of benthic fish food organisms at Stations 8-11 showed a linear recovery pattern. Station 8 had the lowest density and number of taxons, and there was an increase in both population parameters at downstream stations. 3) Large portions of the populations at control stations and at stations 30 miles or further downstream consisted of molluscs. However, these aquatic invertebrates had not recovered at Stations 7-11 below the site of the spill. This failure to recover was probably due to their inability to reinvade and recolonize areas below the spill site as fast as aquatic insects. 4) Community structure analyses indicated that the bottom fauna below the site of the spill were similar in structure to that of stations above the spill site and were characteristic of "clean water" situations. 5) Different species of minnows and darters apparently had recolonized stations below the plant but did not have the density levels found at the upstream control stations. 6) Two years after the spill, the Clinch River had not fully recovered. However, fish food organisms such as mayflies, stoneflies, hellgramites, and midge larvae were present at all the "spill" areas and should support a productive sport fishery. (Authors conclusions)

12276. Hester, Frank J. (Bur. of Comm. Fisheries Fishery-Oceanography Center, LaJolla, California). 1970. SONAR TARGET CLASSIFICATION EXPERIMENTS WITH A CONTINUOUS-TRANSMISSION DOPPLER SONAR. U. S. Dept. of the Interior, U. S. Fish Wildl. Serv. Spec. Sci. Rep. Fish. No. 607, 26 p. illus.

A continuous-transmission sonar with very fine echo frequency discrimination was designed and constructed to study Doppler effects caused by the motion of fish as they relate to fish size and swimming characteristics. Although the equipment performed as theory predicted, difficulties with sea noise and trouble in maintaining contact with fish schools showed that commercial application of this approach is unsuitable without considerable additional development work. These problems and some results are discussed, and notes on target-strength measurements of several species of fishes are included in this report. (Auth.)

12277. Baldwin, John, and P. W. Hochachka (Dept. of Zoology, Univ. of British Columbia, Vancouver, British Columbia, Canada). 1970. FUNCTIONAL SIGNIFICANCE OF ISOENZYMES IN THERMAL ACCLIMATIZATION. ACETYLCHOLINESTERASE FROM TROUT BRAIN. Biochem. J., 116(5): 883-887.

The effects of acclimatization temperature on the catalytic properties of acetylcholinesterase from rainbow-trout brain were examined. Trout brain acetylcholinesterase occurs in two distinct forms. A single 'warm' variant of the enzyme is present after acclimatization to 17°C; a single 'cold' variant appears after acclimatization to 2°C. Both forms are present in fish after acclimatization to an intermediate temperature. The K_m values of the enzyme variants for acetylcholine are temperature-dependent, the lowest values coinciding with the acclimatization temperature at which each enzyme was induced. It is concluded that the K_m-temperature relationship is adaptive, and that the critical process during thermal acclimatization, in cases where enzymes show sharp changes in K_m with temperature, is the synthesis of a new enzyme variant that is better suited for catalysis and control of catalysis under the conditions of the acclimatized state. (Authors)

12278. Kemp, P., and M. W. Smith (Departments of Biochemistry and Physiology, Agricultural Res. Council Inst. of Animal Physiology, Babraham, Cambridge, United Kingdom). 1970. EFFECT OF TEMPERATURE ACCLIMATIZATION ON THE FATTY ACID COMPOSITION OF GOLDFISH INTESTINAL LIPIDS. Biochem. J., 117(1): 9-15.

The fatty acid composition of whole goldfish, whole-intestinal mucosa, intestinal mucosal membranes and individual phospholipids extracted from mucosal membranes were measured, fish adapted to different temperatures being used. Alterations of the adaptation temperature did not noticeably affect the fatty acid composition of the whole-fish lipids, but there were marked changes in the fatty acids of lipids extracted from homogenates of goldfish intestinal mucosa. These changes were more pronounced in a membrane fraction prepared from these homogenates. Raising the adaptation temperature by 20°C halved the percentage of $C_{20:1}$, $C_{20:4}$ and $C_{22:6}$ fatty acids and nearly doubled the percentage of $C_{18:0}$ and $C_{20:3}$ fatty acids recovered. Choline phosphoglycerides constituted about one-half and ethanolamine phosphoglycerides about one-quarter of the total membrane phospholipids. The fatty acids of choline and ethanolamine phosphoglycerides were more susceptible to temperature-dependent changes than were the phosphoglycerides of inositol or serine. The increase in $C_{18:0}$ fatty acid that occurred in membranes of warm-adapted fish was greatest for ethanolamine phosphoglycerides, but increases also occurred in other phospholipid fractions and in membrane neutral lipids. (Authors)

12279. Daly, Richard J. (Bur. of Comm. Fisheries, Tropical Atlantic Biological Lab., Miami, Florida). 1970. SYSTEMATICS OF SOUTHERN FLORIDA ANCHOVIES (PISCES: ENGRAULIDAE). Bull. Marine Science, 20(1): 70-104.

Counts of gill rakers, vertebrae, and dorsal-, anal-, and pectoral-fin rays of the five common species of the family Engraulidae in southern Florida were analyzed and found to vary little within the species. Pigmentation and proportional characters are described and compared, and a key to specimens measuring 40 to 70 mm SL is presented. The five species - Anchoa lamprotaenia Hildebrand, Anchoa hepsetus (Linnaens), Anchoa nasuta Hildebrand and Carvalho, Anchoa mitchilli (Valenciennes), and Anchoviella perfasciata (Poey) - are discontinuously distributed in southern Florida and reach great seasonal abundance. The fishes observed fed in currents at night and formed large schools (composed of a mixture of species) in protected areas to escape predation during the day. (Auth.)

12280. Monan, Gerald E. (Bur. of Comm. Fisheries, Fish-Passage Research Program, Seattle, Washington). 1966. AIDS TO FISH TATTOOING. Progr. Fish Cult., 28(1): 57-59, illus.

12281. Coleman, Mary J., and H. B. N. Hynes (Dept. of Biology, Univ. of Waterloo, Waterloo, Ontario, Canada). 1970. THE VERTICAL DISTRIBUTION OF THE INVERTEBRATE FAUNA IN THE BED OF A STREAM. Limnol. & Oceanogr., 15(1): 31-40.

A type of sampler is described that permits the collection of benthic fauna to a depth of 30 cm in the beds of streams. It depends on the colonization of natural substratum placed into the streambed, and invasion can occur both horizontally and vertically downward. When fully colonized, these samplers collect many times the number of animals taken by vigorous stirring of the substratum upstream of a net. Sets of samplers in which only one of four possible horizontal layers about 7.5 cm deep was available for colonization were emplanted in an Ontario stream and lifted from 1 to 28 days later. The total numbers of many types of animals increased steadily with time in all 4 layers; more than 28 days are probably needed for full colonization. When all the catches are considered together only about 20% of the total was in the top layer, about 26% was in the bottom layer, and the rest was about evenly distributed in the two middle layers. This type of distribution was found for all the groups of animals present. Only Simulium appeared to be normally confined to the surface of the substratum. It is suggested that significant numbers of animals occur deep within the substrata of stony streams, and that even samples collected down to 30 cm do not adequately represent the fauna. (Authors)

12282. Whitear, Mary (Dept. of Zoology, University College, London, England). 1970. THE SKIN SURFACE OF BONY FISHES. J. Zool., Lond., 160(4): 437-454.

The cuticle described by light microscopists on the skin of various fishes, has been studied by electron microscopy in several species of teleost and in two other actinopterygian fish. The cuticle consists of an external coating layer, probably of mucopolysaccharide, which is secreted from the surface epidermal cells, not from the goblet mucous cells. The thickness of the cuticle is commonly of the order of 1 μm. It is particularly well developed in Trigla, where its thickness may vary from a fraction of a micron up to 50 μm, on different parts of the same individual. The cuticle has been detected in species from diverse orders, and is probably a normal constituent of the skin of all bony fishes. It is frequently lost during histological preparation. The external coat continues over the apertures of taste-buds, and may be continuous with the secretion at the mouths of chloride secreting cells. The secretion of the cuticle is partly from, or through, the outer membrane of the epidermal cells, but there is some evidence that cytoplasmic inclusions in the surface epidermal cells are also involved. There is striking variation in the appearance of these inclusions in electron micrographs of different species, and in some cases in different parts of the same fish, notably in Blennius. Certain of the inclusions are membrane-bounded vesicles whose contents are more electron-dense after staining with phosphotungstic acid than with lead citrate. In other cases, the inclusions are electron-transparent vacuoles. The cuticle is briefly compared with similar structures in other aquatic animals. (Auth.)

12283. McCormack, Jean C. (Freshwater Biological Assn., Ambleside, England). 1970. OBSERVATIONS ON THE FOOD OF PERCH (Perca fluviatilis L.) IN WINDERMERE. J. Anim. Ecol., 39(1): 255-267.

The food of perch (Perca fluviatilis L.) in Windermere was investigated by examining 1128 stomachs during the months of April-September inclusive in the years 1963-67. Fish examined ranged from 9.0 to 29.0 cm in length. Since 1940 there have been intensive fisheries for perch and pike (Esox lucius L.) in Windermere, the perch population has been severely reduced and the age structure of the pike population has been completely changed. Perch of all size groups ate planktonic crustacea and benthic fauna, the amounts varied from month to month and so did the numbers of different kinds of organisms eaten. Fish, mainly minnow (Phoxinus phoxinus L.) and perch, was eaten, especially in August. The food of perch was compared with the results obtained by Allen in 1935. It was found that, while animals eaten were similar, the proportions were very different. The clear divisions between planktonic, benthic and fish-eating perch demonstrated by Allen are no longer obvious. Asellus was not recorded by Allen. It is now one

of the most important of the food animals. The stomachs of 35% of all the perch examined were empty. The greatest number of empty stomachs occurred in August. (Auth.)

12284. Umminger, Bruce L. (Dept. of Biology, Yale Univ., New Haven, Connecticut). 1970. PHYSIOLOGICAL STUDIES ON SUPERCOOLED KILLIFISH (Fundulus heteroclitus). III. CARBOHYDRATE METABOLISM AND SURVIVAL AT SUBZERO TEMPERATURES. J. exp. Zool., 173(2): 159-174.

The previously reported hyperglycemia induced in Fundulus heteroclitus by exposure to the subzero cold was investigated in more detail. It was found that the hyperglycemic response was elicited immediately when fish were transferred to water at −1.5°C and that the striking increase in serum glucose was accompanied by a progressive depletion of hepatic glycogen. Muscle glycogen occasionally, but not always, showed a slight depletion after long exposure to the subzero cold. Serum glucose was not maintained at high levels indefinitely in the subzero cold. After hepatic glycogen was totally depleted, serum glucose levels began to drop. When serum glucose levels fell to normal, the fish began to die. Addition of glucose to the water elevated serum glucose levels and enhanced survival in the subzero cold. Winter fish, which produce higher levels of serum glucose in the subzero cold than do summer fish, survived the subzero cold almost twice as long as did summer fish. Serum non-glucose free carbohydrate levels were unaffected by the length of exposure to subzero temperatures. Liver protein levels were unaffected by temperatures from 20°C to −1.5°C and muscle protein levels decreased slightly only after long exposure to the subzero cold. (Auth.)

12285. Skidmore, J. F. (Dept. of Zoology, Univ. of Bristol, England). 1970. RESPIRATION AND OSMOREGULATION IN RAINBOW TROUT WITH GILLS DAMAGED BY ZINC SULPHATE. J. exp. Biol., 52(2): 481-494.

Damage to the gill epithelium occurs when hatched fish are killed rapidly by solutions of zinc sulphate. The rate of routine oxygen uptake by lightly sedated, quiet, rainbow trout did not alter on exposure to a rapidly toxic solution of zinc sulphate. However, oxygen utilization decreased seven-fold, gill ventilation volume increased six-fold, heart rate was halved, coughing rate increased 18-fold and the P_{O_2} of dorsal aortic blood declined. Unsedated trout usually struggled on exposure to zinc. The survival time of struggling fish was reduced and oxygen uptake increased, but other physiological changes were similar to those in quiet fish. The respiratory changes in poisoned trout were generally similar to changes observed earlier in the same fish under hypoxia. The osmotic concentration and the concentrations of sodium, potassium, calcium, magnesium and zinc in blood were largely unaffected by immobilization in zinc sulphate solution. Trout survived a four-fold increase in zinc concentration in the blood by injection. The results suggest that epithelial damage decreased the permeability of the gills to oxygen, and did not increase their permeability to cations. Zinc was not a rapid internal poison. Death was probably caused by tissue hypoxia, when maximum gill ventilation was no longer sufficient to supply the oxygen needs of the fish. (Auth.)

12286. Hopper, Arthur F., and Edith Wallace (Dept. of Zoology, Rutgers Univ., New Brunswick, New Jersey). 1970. ANAL FIN REGENERATION IN THIOURACIL-TREATED GUPPIES. J. exp. Zool., 173(3): 251-262.

Male guppies were kept in a solution of 0.03% thiouracil for 45 days. At this time the gonopodium was cut back and then allowed to regenerate while the fish were maintained in one of the following solutions: (1) thiouracil, (2) aged tap water, (3) 0.01% thyroid powder, (4) 1:500,000 ethynyl testosterone, (5) ethynyl testosterone and thyroid powder, (6) ethynyl testosterone and thiouracil, (7) thyroid powder and thiouracil. Regeneration was greatly inhibited in solutions 1, 2, 5 and 7. Regeneration was normal or almost so in solutions 3, 4 and 6. It is concluded that the thiouracil-induced inhibition of regeneration of the gonopodium of the guppy is due to the effect of thiouracil on the formation or release of testicular hormones. (Authors)

12287. Kipling, Charlotte, and Winifred E. Frost (Freshwater Biological Assn., The Ferry House, Ambleside, Westmorland, England). 1970. A STUDY OF THE MORTALITY, POPULATION NUMBERS, YEAR CLASS STRENGTHS, PRODUCTION AND FOOD CONSUMPTION OF PIKE, Esox lucius L., IN WINDERMERE FROM 1944 TO 1962. J. Anim. Ecol., 39(1): 115-157.

Pike have been caught in fine flax gill nets (mesh 6.4 cm, bar) each winter from 1944-45 to 1964-65. The total catch was 7751 pike, in 1944-45 756 were caught, and from 1945-46 to 1964-65 the average annual catch was 350. The age and growth of all pike were determined. Pike were tagged every year from 1949 to 1965. At first tags were attached to the opercular bones, but this method proved unsatisfactory, so from 1953 all tags were attached to the jaw. Up to 70% of tagged pike were recaptured, mostly by gill nets and anglers. Natural instantaneous mortality rates in the third year of life were estimated from recaptured tagged fish as 0.42 (both sexes), and in the fourth and subsequent years as 0.30 for females and 0.35 for males from age frequencies of pike caught in 1944-45. Instantaneous mortality rates in the south basin due to gill netting varied from 0.24 to 0.45 in the years 1954-64 (ignoring the years of reduced nettings) as estimated from recaptured tagged fish. Anglers caught from 2 to 23% of the pike tagged from perch traps and gill nets in the years 1949-62. The total instantaneous mortality rate of females in the south basin was estimated from gill net catches to be 0.75 (53% per annum). In the north basin the mortality was 4% higher than in the south basin, and male mortality was 3% higher than female. In 1944 the estimated population of adult pike in Windermere was 2300 fish. The virtual population (i.e. those fish which were in the lake in 1944 and were subsequently caught) was 1343 fish. The maximum estimated population of adult pike was 4600 and the minimum 1400. In 1944 there were almost equal numbers of pike in the north and south basins, and almost equal numbers of males and females. The largest year class was five times as numerous as the smallest. From 1944 to 1965 the proportion of male pike caught in gill nets has varied from 49 to 64% of the total catch. These variations are associated with the selective action of the gill nets, and differences from year to year in year class strengths and growth, and the slower growth of male pike. Pike inhabit the shallow water and in Windermere there are 550 ha of depth 10 m and less. In 1944 the population density of adult pike in this area was 8.4 kg/ha and 4.2 fish/ha. From 1945 to 1962 the maximum density was 9.5 kg/ha and 8.3 fish/ha and the minimum 3.6 kg/ha and 2.5 fish/ha. Total production of adult pike was estimated as 2.2 metric tons in 1944-45. From 1945-46 to 1962-63 the maximum was 3.7 metric tons and minimum 1.3 metric tons. The biomass of adult pike was estimated as 4.6 metric tons in 1944, from 1945 to 1962 the maximum was 5.2 metric tons, minimum 2.0 metric tons. Total food consumption of adult pike was estimated as 10.9 metric tons in 1944-45. From 1945-46 to 1962-63 the maximum was 14.7 metric tons, minimum 6.1 metric tons. In the first year of life mean production was estimated as 3.2 metric tons, and food consumption as 8.7 metric tons. In the second year of life maximum production of year classes 1942-62 was 6.7 metric tons and minimum 1.0 metric tons. Maximum food consumption was 20.0 metric tons and minimum 3.0 metric tons. Production and food consumption in the first 2 years of life formed respectively 72 and 63% of the totals estimated for the 1951 year class. Year class strengths of pike hatched from 1944 to 1962 were very significantly correlated with temperature conditions in the first year of life, and significantly correlated with first year growth. They were not significantly correlated with either the numbers or biomass of the parent stock. Correlations of year class strengths against temperatures in the separate months were very significant in September and October, significant in July and August, and not significant in May and June. From laboratory experiments, which were carried out to find possible causes of mortality in eggs and alevins, it was found that contact with sand or silt did not kill the eggs. In the first feeding stage (lengths from 11 to 24 mm) mortality and growth were related to amounts of zooplankton provided. Cannibalism occurred among fry. Variations in year class strengths(which were greatly influenced by temperature) were found to be very important in determining the amount of production and food consumption. (Authors summ.)

12288. Morsell, John W. (Bur. of Research, Northeast District Headquarters, Woodruff, Wisconsin). 1970. FOOD HABITS AND GROWTH OF YOUNG-OF-THE-YEAR WALLEYES FROM ESCANABA LAKE. PRELIMINARY REPORT. Dept. of Natural Resources, Madison, Wis., Research Report No. 56, 14 p.

A total of 531 walleye stomachs were examined in 1964-68. The major food item for 3 of the 5 years was fish, most of which were identified as yellow perch. The major invertebrates consumed were Chaoborus, Leptodora and Chironomidae, with their relative importance in the walleye diet fluctuating from year to year. During the same 5-year period, 2, 184 young-of-the-year walleyes and 1, 342 young-of-the-year yellow perch were measured. The highest consumption of yellow perch occurred in those years when walleye growth was fastest and the lowest fish consumption occurred in those years when walleye growth was slowest. Years of slow walleye growth corresponded to years when invertebrates predominated in the diet. For most years, the percentage of yellow perch found in walleye stomachs declined in midsummer as a result of the relative growth of the 2 species: yellow perch greater than half the size of the young-of-the-year walleyes were not used as a forage species by the walleyes. (Auth.)

12289. Loeffler, Clarence A., and Søren Løvtrup (Dept. of Zoophysiology, Univ. of Umea, Sweden). 1970. WATER BALANCE IN THE SALMON EGG. J. exp. Biol., 52(2): 291-298.

The rate of water exchange in the salmon egg was determined by means of the electromagnetic diver-balance. Salmon eggs treated with alcohol to remove the plasma membrane were used to determine the diffusion coefficient, D, for water in the cytoplasm, and untreated eggs to determine the permeability coefficient, E, for water through the plasma membrane. It was found that D is of the same order as that observed in other eggs, whereas the value of E is somewhat lower, but still within the same order of magnitude. The results do not confirm the classical notion that the salmon egg is impermeable to water, but they show that the exchange is extremely slow, the half time being about 24 hr. In order to explain this result the contribution of egg size and environmental temperature must be taken into account. It is concluded that the actually observed rate of swelling corresponds to that anticipated from the recorded permeability coefficient, and that there is therefore no reason to presume that any kind of osmoregulation takes place. (Authors summ.)

12290. Hishida, Tomi-o, and Noriko Kawamoto (Biological Inst., Fac. of Science, Nagoya Univ., Nagoya, Japan). 1970. ANDROGENIC AND MALE-INDUCING EFFECTS OF 11-KETOTESTOSTERONE ON A TELEOST, THE MEDAKA (Oryzias latipes). J. exp. Zool., 173(3): 279-284.

The androgenic and the male-inducing (androtermonic) activities of 11-ketotestosterone were evaluated respectively by its abilities to stimulate a secondary sex character and to reverse gonadal sex differentiation in a teleost, the medaka (Oryzias latipes). The median effective dose (ED 50) of this steroid necessary to induce the formation of papillar process on the anal fin was 37 μg/g of food. The androgen is therefore about 8 times more potent than testosterone propionate and 17 times more potent than pure testosterone in the same test. The ED 50 for androtermonic activity (reversal of genetic females to phenotypic males) was found to be about 110 μg/g of food. Compared with testosterone propionate the 11-keto compound is about five times more potent. Thus, in teleosts, 11-ketotestosterone appears to be the most potent androgen of vertebrate origin for both androgenic and androtermonic potencies. The ratio of androtermonic to androgenic potencies (ED 50s) for 11-ketotestosterone is 3.0. (Authors)

12291. Jackson, H. W. (Fed. Water Pollution Control Admn., Cincinnati, Ohio). 1970. A CONTROLLED-DEPTH, VOLUMETRIC BOTTOM SAMPLER. Progr. Fish Cult., 32(2): 113-115.

A shallow-water grab-type sampler described here can sample in any type of bottom (except solid rock or large rubble) over the entire area encompassed by its jaws.

12292. Schäperclaus, W. 1969. FISH INFECTIONS CAUSED BY VIRUSES. (Virus infektionen bei Tieren). In: Handbook of Virus Infections in Animals. (Handbuch der Virusinfektionen bei Tieren) edited by Heinz Röhrer. G. Fisher Verlag, Jena, Germany, Vol. V/2, pp. 1067-1141.

This is a very concise, complete and up-to-date text on fish infections caused by viruses. It contains 28 black and white illustrations. The text consists of historical introduction, methods of fish examination and descriptions of the following diseases: lymphocystis; fishpox; cauliflower disease of eels; other diseases characterized by hyperplasia; viral hemorrhagic septicemia (of rainbow trout); infectious pancreatic necrosis; viral diseases of Pacific salmonids; and infectious dropsy of Cyprinidae (also known as bacterial hemorrhagic septicemia). Included also is a chapter on inadequately described diseases such as contagious stomatitis observed in Brazil, inflammation of the gas bladder in carp and viral disease of channel catfish. Also discussed are viral infections (orphan viruses) which cause no diseases. There is a separate chapter on control of viral fish diseases and at the end -- a review chapter of fish infections caused by viruses. Description of each important virus disease consists of sections on definition, history of research, pathology, histology and symptomatology, etiology, epizootiology, economic significance and control. Description of each disease is followed by a well selected and almost complete bibliography. -- S. F. Snieszko

12293. Regan, Danny M., Thomas L. Wellborn, Jr., and Robert G. Bowker. 1968. STRIPED BASS Roccus saxatilis (Walbaum). DEVELOPMENT OF ESSENTIAL REQUIREMENTS FOR PRODUCTION. U. S. Dept. of Interior, Fish & Wildl. Serv., Bur. of Sport Fisheries & Wildl., Div. of Fish Hatcheries, Atlanta, Georgia, 133 p.

Includes: Egg procurement from striped bass at the Edenton, North Carolina, National Fish Hatchery; supplemental feeds, feeding techniques, and stocking rates employed in the production of striped bass; availability and utilization of zooplankton encountered during the production of striped bass in hatchery ponds; water quality standards essential to the establishment of a successful striped bass production program; techniques employed in harvesting and distributing fingerling striped bass; adaptability of the white bass x striped bass to production in hatchery ponds; disease and parasite problems encountered during the production of striped bass; use of hatchery troughs and tanks for producing striped bass fingerlings; the toxicity of nine therapeutic and herbicidal compounds to striped bass.

12294. Smith, Quentin, and Irving W. Jones (Fish Comm. of Oregon, North Nehalem Salmon Hatchery, Nehalem, Oregon). 1970. TURNING-VANE BRUSH FOR RECIRCULATING PONDS. Progr. Fish Cult., 32(2): 119-120.

A brush made of aluminum bar stock and black polypropylene removed algal growth from the turning vanes in a Burrows-type recirculating raceway pond in a third of the time previously required.

12295. Belyanina, T. N. (Inst. of Evolutionary Morphology and Ecology of Animals, Academy of Sciences, Moscow, USSR). 1969. SYNOPSIS OF BIOLOGICAL DATA ON SMELT Osmerus eperlanus (Linnaeus) 1758. FAO Fisheries Synopsis No. 78, Illus.

Includes: Identity; distribution; bionomics and life history; population; exploitation; protection and management; pond fish culture; and bibliography.

12296. Alabaster, John S. (Ministry of Agriculture, Fisheries and Food, London, England). 1970. RIVER FLOW AND UPSTREAM MOVEMENT AND CATCH OF MIGRATORY SALMONIDS. J. Fish Biol., 2(1): 1-13.

Six years' data from the River Coquet together with published information for other British rivers show that upstream migrant salmon and sea trout tend to be intercepted at counting fences and be caught on rod and line when river flows are somewhat higher than average and not when they are at their extreme values, though there is no particular river flow favoured all the year round. In years of highest river discharge the number of fish entering the River Coquet and the number of fish caught on rod and line are highest but the efficiency of angling is lowest. (Auth.)

12297. Stott, Brian (Salmon and Freshwater Fish. L ' , Ministry of Agriculture, Fisheries and Food, London S. W. 1, England). 1970. SOME FACTORS AFFECTING THE CATCHING POWER OF UNBAITED FISH TRAPS. J. Fish Biol., 2(1): 15-22.

Perch Perca fluviatilis L. newly introduced into waters were markedly vulnerable to traps for up to four or five days. Thereafter catches tended to be positively correlated with water temperature up to about 10.5°C and negatively correlated at higher temperatures. The catching power of traps is low; at a density of one per 354 m^2 water surface, traps caught from 0.9 to 6.8% and 0.3 to 1.4% of a perch and roach Rutilus rutilus (L.) population per day. Perch did not become 'trap-shy' and fin clipping did not affect their vulnerability. Applications of 0.1 to 0.5 ppm copper sulphate resulted in up to an 11-fold increase in catches (Auth.)

12298. MacKenzie, K. (Marine Lab., Aberdeen, Scotland). 1970. Gyrodactylus unicopula Glukhova, 1955, FROM YOUNG PLAICE Pleuronectes platessa L. WITH NOTES ON THE ECOLOGY OF THE PARASITE. J. Fish Biol., 2(1): 23-24.

A population of Gyrodactylus unicopula Glukhova, 1955, is described from the gill filaments of young plaice from a nursery ground on the northwest coast of Scotland. The seasonal incidence of this parasite was followed by sampling the 1965 year class of plaice at intervals of from one to three months from April 1965 to April 1967. The level of intensity is usually low and shows no progressive increase, although the fish are shown to be capable of supporting much higher populations of the parasite, which suggests the existence of some mechanism controlling the level of intensity in the natural population. The distribution of G. unicopula on the filamentous surface of the gills is shown in detail. X^2 analyses indicated no significant association or antagonism between this parasite and two ciliates commonly found on the gills of the same population of plaice. Gyrodactyliasis, the disease caused by parasites of the genus Gyrodactylus, is discussed with special reference to marine fish farming. (Auth.)

12299. Arme, C., and R. Wynne Owen (Dept. of Zoology, The University, Leeds 2, England). 1970. OBSERVATIONS ON A TISSUE RESPONSE WITHIN THE BODY CAVITY OF FISH INFECTED WITH THE PLEROCERCOID LARVAE OF Ligula intestinalis (L.) (CESTODA: PSEUDOPHYLLIDEA). J. Fish Biol., 2(1): 35-37.

Infection of certain species of cyprinid fish with the plerocercoid larva of the cestode Ligula intestinalis is accompanied by a host tissue response. The tissue reaction is evident in roach Rutilus rutilus as young as three months. An initial cellular infiltration is followed by the laying down of sheets of connective tissue. A case of calcification is described in a single infected rudd Scardinius erythrophthalmus. (Authors)

12300. Mackay, David W. (The Clyde River Purification Bd., East Kilbride, Glasgow, Scotland). 1970. POPULATIONS OF TROUT AND GRAYLING IN TWO SCOTTISH RIVERS. J. Fish Biol., 2(1): 39-45.

Major pollutions resulted in the deaths of all fish in 8 km long stretches of two trout streams in central Scotland. Fish were collected, measured and weighed and the ages established by scale-reading. The predominant species present were Salmo trutta (L.)and Thymallus thymallus (L.) with about five times as many trout as there were grayling in each stream. The Douglas Water, which was previously unpolluted, held five times as many fish as the River Gryfe which had a history of intermittent pollution. The trout and grayling of the River Gryfe grew faster than those from the Douglas Water and there were more of the larger sizes present. (Auth.)

12301. Scarola, John F., and Jeffrey H. Giberson, Bur. of Commercial Fisheries, Seattle, Washington). 1967. A DEVICE FOR SORTING BOTTOM ORGANISMS. Progr. Fish Cult., 29(4): p. 242, illus.

12302. Martin, P., and N. R. Bromage (Dept. of Biological Sciences, Univ. of Aston in Birmingham, Gosta Green, Birmingham 4, England). 1970. THE EFFECT OF METHALLIBURE ON SPERMATOGENESIS IN Poecilia reticulata. J. Fish Biol., 2(1): 47-51.

Methallibure treatment in Poecilia reticulata resulted in an interruption of spermatogenesis. This inhibition occurred at the stage of transformation of secondary spermatogonia to primary spermatocytes. The possible endocrine nature of this inhibition is discussed and it is suggested that treatment with Methallibure might provide a suitable alternative to surgical hypophysectomy in the study of pituitary-gonad relationships in teleosts. (Authors)

12303. Mathews, C. P. (Zoology Dept., Univ. of Reading, Reading, Berks, England). 1970. IMMERSION STAINING OF COARSE FISH IN THE THAMES. J. Fish Biol., 2(1): 57-58.

Thirty-one vital dyes were screened for marking bleak, roach and gudgeon by total body immersion in aqueous solutions of the dye. Only six dyes stained without killing, and of these Nile blue, neutral red and Bismarck brown were used successfully in the field. This approach to estimation of population size was abandoned because (1) the toxicity of the dyes varied at different times of year, (2) the numbers needed for release were impractically high and (3) fingerlings showed extremely high mortality on handling. (Auth.)

12304. Havey, Keith A., and Robert M. Davis (Maine Dept. of Inalnd Fisheries and Game, Machias, Maine). 1970. FACTORS INFLUENCING STANDING CROPS AND SURVIVAL OF JUVENILE SALMON AT BARROWS STREAM, MAINE. Trans. Amer. Fish. Soc., 99(2): 297-311.

Biological and physical variables influencing survival and standing crops of juvenile salmon are treated by regression analyses to determine those variables of greatest significance. Stream flow in dry seasons as indicated by rainfall proved to be the most important single factor influencing survival from age 0+ to age 1+ in the presence of such other variables as standing crops of other fishes and water temperatures. A Chi-square test indicated that the various species of fish present in Barrows Stream during the 6 year study reacted to electrofishing as though they were a single species. Indications are that construction of small water storage dams at appropriate sites in the headwaters of salmon nursery areas could increase survival and growth rate of juvenile salmon occupying the nurseries. (Authors)

12305. Shetter, David S., and Gaylord R. Alexander (Michigan Dept. of Natural Resources, Hunt Creek Fisheries Res. Station, Lewiston, Michigan). 1970. RESULTS OF PREDATOR REDUCTION ON BROOK TROUT AND BROWN TROUT IN 4.2 MILES (6.76 km) OF THE NORTH BRANCH OF THE AU SABLE RIVER. Trans. Amer. Fish. Soc., 99(2): 312-319.

During the autumns of 1964, 1965 and 1966, brown trout 12.0-25.1 inches (305-638 mm) in length were removed from 4.2 miles (6.76 km) of the North Branch of the Au Sable River (Dam 2-County Line), and American mergansers were harassed in the same area each winter as time permitted. The objective was to decrease losses among the smaller salmonids which would otherwise be eaten by the large trout and mergansers. Effects of control efforts were assayed by comparison of 1965-67 angling results and population estimates with similar data accumulated on the test section and two other stream sections of the North Branch during 1961-64 when predator manipulation was not carried on. In 1964, 561 large brown trout (66% of the estimated population) were removed. In 1965 and 1966, the actual removals were 346 and 104, or 63 and 40% of the population, respectively. The only major change noted was an increase during 1965, 1966 and 1967 in numbers of brook trout larger than 9 inches (229 mm) in the population estimates. However, this population increase did not affect the anglers' catches of brook trout during 1965-1967. No significant changes in the catch or population of brown trout could be demonstrated. No significant differences in average lengths of the age groups of both brook trout and brown trout, which might be ascribed to predator manipulation, were found. It was concluded that predator reduction

would have to be conducted at a considerably higher level of intensity to induce major changes in trout populations and in the subsequent anglers' catch. (Authors)

12306. Cramer, Joe D., and G. Richard Marzolf (Div. of Biology, Kansas State Univ., Manhattan, Kansas). 1970. SELECTIVE PREDATION ON ZOOPLANKTON BY GIZZARD SHAD. Trans. Amer. Fish. Soc., 99(2): 320-332.

Food selection by a planktivorous fish, the gizzard shad, Dorosoma cepedianum, was studied in Tuttle Creek Reservoir, Kansas. To determine if selection was occurring a fish stomach sample and a plankton sample were taken concurrently at 22 separate sampling times during the study. Percent composition of the various food items in paired stomach and plankton samples was compared by an electivity (E) index. Four least squares analyses of variance were performed on the E index values to determine which factors (i.e., species of plankton, date of collection, time-day or night, size-class of fish or size-class of plankton) explained most of the variation in E and thus was responsible for selection by gizzard shad. Differences between the species of plankton in the analysis was found to be the most consistent factor contributing to selection. Differences in size, mobility, behavior, and so forth might be considered as causative agents responsible for positive or negative selection by gizzard shad. Of these species differences, organism size was shown to be of some importance. In addition to species (plankton), the other factors mentioned appear to contribute to selection, but to a lesser extent. If young gizzard shad are selective in their feeding, then the impact of the shad spawn should be observable in changes in zooplankton species composition and population size during the time when the carnivorous life history stages of this fish are present in the environment. To test this hypothesis the zooplankters were assigned to "selected for" and "selected against" groups. The "selected for" group declined to much lower density than did the "selected against" group. The decrease in zooplankton density, particularly the marked decrease in the "selected for" group, supports the hypothesis that selective predation by young shad has an impact on zooplankton populations. (Authors)

12307. Minckley, W. L., James E. Johnson, John N. Rinne, and Sandra E. Willoughby (Dept. of Zoology, Arizona State Univ., Tempe, Arizona). 1970. FOODS OF BUFFALOFISHES, GENUS Ictiobus, IN CENTRAL ARIZONA RESERVOIRS. Trans. Amer. Fish. Soc., 99(2):333-342.

Intestinal tracts of 541 buffalofishes, genus Ictiobus (428 bigmouth, 57 black, and 56 smallmouth) caught in 1966-69 in central Arizona reservoirs were analyzed. Bigmouth buffalo (I. cyprinellus) from Roosevelt and Apache lakes fed mostly on planktonic algae and crustaceans, with indications of a near-bottom feeding habit. Black (I. niger) and smallmouth (I. bubalus) buffalo fed on benthic macro-invertebrates, with molluscs being the most important group utilized by both species. (Authors)

12308. McEachran, John D., and Jackson Davis (Virginia Inst. of Marine Science, Gloucester Point, Virginia). 1970. AGE AND GROWTH OF THE STRIPED SEAROBIN. Trans. Amer. Fish. Soc., 99(2): 343-352.

Age, rate of growth, spawning, and weight-length relationship of the striped searobin, Prionotus evolans, were studied. The fish were collected from Chesapeake Bight and Chesapeake Bay during 1966 and 1967. Age was determined from otoliths which had been cross-sectioned, polished, and heated. Age groups 0 to VII were represented in the sample of 803 specimens. Males and females had the same growth rate and weight-length relationship. Growth in length was rapid until the fish reached maturity at age II. Age group II averaged 221 mm fork length. The fish accomplished most annual growth between May and September. Spawning occurred from May through the first part of July. (Authors)

12309. Scarola, John F. (Bur. of Comm. Fisheries Biological Lab., Seattle, Washington). 1968. CLADOCERA AND COPEPODA IN McNARY RESERVOIR, 1965-66. Northwest Science, 42(3): 112-114.

12310. Bellinger, John W., and James W. Avault, Jr. (School of Forestry and Wildlife Management, Louisiana State Univ., Baton Rouge, Louisiana). 1970. SEASONAL OCCURRENCE, GROWTH, AND LENGTH-WEIGHT RELATIONSHIP OF JUVENILE POMPANO, Trachinotus carolinus, IN LOUISIANA. Trans. Amer. Fish. Soc., 99(2): 353-358.

Juvenile pompano (Trachinotus carolinus) were collected with beach seines from Grand Isle, Louisiana, during the summer of 1968. Additional fish were obtained from Holly Beach, Louisiana, to supplement length-weight data. Length-frequency distributions of 4,082 fish were used to follow the arrival and growth of juveniles at Grand Isle. Seven waves of juvenile recruitment were recognized. The estimated time of arrival of the first wave was mid-April; the last wave arrived in early September. Other waves arrived approximately 15 to 30 days apart; the heaviest concentration of fish on the beach was from June through early August. Length-frequency data indicated that juvenile pompano grew an average of 36 mm per month, with a range from 27 to 42 mm. Water temperatures ranged from 17.5 to 34.0C at Grand Isle. Salinities were as low as 12.5 ppt at Holly Beach and as high as 32.6 ppt at Grand Isle. Data failed to show any relationship between temperature, salinity, and the seasonal arrival of juvenile pompano at Grand Isle. The calculated length-weight relationship for juveniles in the size range 10-125 mm (total length) was log W = 4.8152 + 2.9776 log L. (Authors)

12311. Jensen, Albert C. (Div. of Marine and Coastal Resources, New York State Conservation Dept., Ronkonkoma, New York). 1970. VALIDATION OF AGES DETERMINED FROM OTOLITHS OF GULF OF MAINE COD. Trans. Amer. Fish. Soc., 99(2): 359-362.

The validity of age determinations from otoliths of Atlantic cod (Gadus morhua) captured in the Gulf of Maine is demonstrated. Otoliths were obtained from fish taken in the commercial fishery and from research vessel collections. The cod were from 9.7 cm to 110.0 cm, fork length. Growth zones in the otoliths were examined to determine if one hyaline and one opaque zone are formed annually. Age distribution of the samples was compared to a plot of the length frequency distribution (Petersen method). Evidence is strong that one hyaline and one opaque zone are formed each year. The hyaline zone is counted as the year mark. It begins to form in June. Modes in the age distribution for the first three age-groups of cod agree well with modes in the length-frequency distribution. (Auth.)

12312. Coble, Daniel W. (Missouri Cooperative Fishery Unit, Univ. of Missouri, Columbia, Missouri). 1970. FALSE ANNULUS FORMATION IN BLUEGILL SCALES. Trans. Amer. Fish. Soc., 99(2): 363-368.

Bluegill, Lepomis macrochirus, were held in tanks at 24C from November 21, 1967 to February 2, 1968. Of fish given a liberal ration throughout the period, those handled midway through formed a false annulus on their scales, and those that were not handled did not. Some bluegill received a restricted ration for 3-21 days between periods of heavy feeding but were not handled during the experiment. With one exception a false annulus was formed on the scales of only those receiving no food for 10 days or more. False annuli may be caused by fish not eating for some time or not using energy from consumed food for scale growth. Some factors discussed that may be involved in false annulus formation are lack of available food, low temperature, disease, low concentrations of dissolved oxygen and photoperiod. (Auth.)

12313. Moss, Sanford A. (Essex Marine Lab., Essex, Connecticut). 1970. THE RESPONSES OF YOUNG AMERICAN SHAD TO RAPID TEMPERATURE CHANGES. Trans. Amer. Fish. Soc., 99(2): 381-384.

Captive juvenile American shad (Alosa sapidissima) avoided rapid temperature increases of about 4°C above acclimatization temperatures in an experimental tank. Responses to rapid temperature changes of about 1.0°C were not consistent and did not result in demonstrable avoidances. It is concluded that young shad are capable of avoiding potentially lethal temperature changes. (Auth.)

12314. Hassler, Thomas J. (North Central Reservoir Investigations, Bur. of Sport Fisheries and Wildlife, Pierre, So. Dakota). 1970. ENVIRONMENTAL INFLUENCES ON EARLY DEVELOPMENT AND YEAR-CLASS STRENGTH OF NORTHERN PIKE IN LAKES OAHE AND SHARPE, SOUTH DAKOTA. Trans. Amer. Fish. Soc., 99(2): 369-375.

Survival of artificially-fertilized ova and larvae of northern pike, Esox lucius, was estimated from embryos held in natural spawning areas in Lake Oahe and Lake Sharpe, two main stem Missouri River reservoirs. Mortalities approaching 100% during early embryonic development were associated with sudden drops in water temperature below 10C or prolonged temperatures near 5C. Silt deposition of 1.0 mm per day was associated with mortality of 97% or above. Following hatching available food appeared to be a more important factor in survival than temperature change or silt deposition. Estimates of year-class strength of northern pike in the two reservoirs suggest that large year classes were associated with stable to rising water level and temperature, flooded vegetation, and calm weather during the spawning season. Small year classes have been associated with abrupt water temperature fluctuations, dropping water level, and high silt deposits. (Auth.)

12315. Edsall, Thomas A. (U. S. Bur. of Comm. Fisheries, Great Lakes Fishery Lab., Ann Arbor, Michigan). 1970. THE EFFECT OF TEMPERATURE ON THE RATE OF DEVELOPMENT AND SURVIVAL OF ALEWIFE EGGS AND LARVAE. Trans. Amer. Fish. Soc., 99(2): 376-380.

Eggs from Lake Michigan alewives (Alosa pseudoharengus) were incubated at 79 different temperatures from 42.1 to 87.0 F. Hatching occurred at 44.4-84.9 F and was optimum (38% hatched) at about 64 F. Incubation time varied from 15 days at 45 F to 3.7 days at 70 F and 2.1 days at 84 F. Time from start to finish of hatching ranged from 13 days at about 46 F to 2-3 days at 68-70 F and 1-2 days at 80-84 F. Survival of unfed larvae held at incubation temperatures increased from 3.8 days at 51 F to 7.6 days at 58-59 F and then decreased to 2.4 days at 80-82 F. (Auth.)

12316. Grzenda, Alfred R., Doris Fort Paris, and William J. Taylor (Southeast Water Lab., Fed. Water Pollution Control Admn., College Station Road, Athens, Georgia). 1970. THE UPTAKE, METABOLISM, AND ELIMINATION OF CHLORINATED RESIDUES BY GOLDFISH (Carassius auratus) FED A ^{14}C-DDT CONTAMINATED DIET. Trans. Amer. Fish. Soc., 99(2): 385-396.

Goldfish (Carassius auratus) were exposed to a diet containing 50 nanomoles/gram (nmoles/g) ^{14}C-DDT for a maximum of 192 days (total exposure 842 nmoles). Six sacrifices were made during the exposure period and the total residue distribution among the principal tissues determined. The lowest total residue concentrations were noted in muscle, skin, and immature ovary, and the highest in mesenteric adipose, lateral-line nerve, and testes. There was no correlation between the total lipid content of the tissues and the residue concentrations. Semi-logarithmic plots of the DDT uptake data, for most tissues, were characterized by an initial period of rapid uptake followed by linear slopes which approached horizontal. In nearly all cases, the regression coefficients were not statistically significant for the reduced phase of uptake. The percentage composition of DDT, DDE, and DDD was determined for the tissues. The percentage of metabolites increased with continued exposure, in spite of the constant and uniform input of DDT. Another group of goldfish was exposed to 561 nmoles ^{14}C-DDT in their diet and then placed on a residue-free ration to determine the rate of residue elimination. The loss rate was exponential, and the residue half-life values for the tissues averaged 29 days and ranged from 22 to 34 days for lateral-line nerve and mesenteric adipose, respectively. The differences in half-life values were not statistically significant. (Authors)

12317. Tracy, Harry B., Ronald A. Lee, Charles E. Woelke, and Gene Sanborn (State of Washington Water Pollution Control Comm., Washington). 1969. RELATIVE TOXICITIES AND DISPERSING-EVALUATIONS OF ELEVEN OIL-DISPERSING PRODUCTS. J. Wat. Poll. Contr. Fed., 41(12): 2062-2069.

12318. Hennick, Daniel P., and Richard W. Tyler (Alaska Dept. of Fish and Game, Kodiak, Alaska). 1970. EXPERIMENTAL MARKING OF EMERGENT PINK SALMON (Oncorhynchus gorbuscha) FRY WITH SPRAYED FLUORESCENT PIGMENT. Trans. Amer. Fish. Soc., 99(2): 397-400.

The effects of various spraying pressures in fluorescent pigment marking on mark retention and mortality of emergent pink salmon fry were determined. The fry were sprayed in groups of 1,000 at pressures of 110, 90, 70 p.s.i., and were held with a control group in salt water in live pens for 31 days. The experiment was terminated at this time because of the effects of starvation on the fry. Checks at 14 and 31 days postmarking showed no significant difference in mark retention between groups (mean rate = 76.2%) and no loss of marks between check periods. Mortalities due to marking occurred entirely during the first 2 days postmarking and were related directly to spraying pressure (8.9% at 110 p.s.i.; 0.5% at 70 p.s.i.). (Authors)

12319. Beardsley, Grant L., Jr. (Bur. of Comm. Fisheries, Tropical Atlantic Biological Lab., Miami, Florida). 1970. DISTRIBUTION OF MIGRATING JUVENILE PINK SHRIMP, Penaeus duorarum duorarum Burkenroad, IN BUTTONWOOD CANAL, EVERGLADES NATIONAL PARK, FLORIDA. Trans. Amer. Fish. Soc., 99(2): 401-408.

The vertical and horizontal distribution of migrating juvenile pink shrimp, Penaeus d. duorarum Burkenroad, in Buttonwood Canal, Everglades National Park, Florida, was studied by sampling with 13 small, conical nets. Samples were taken during darkness on the ebb tide, and were scheduled thrice monthly for 13 months to coincide with the full moon, new moon, and either the last- or first-quarter moon. Juvenile pink shrimp responded positively to moonlight by moving to the surface of the canal during the ebb tide. They probably stayed on the bottom or along the sides of the canal during flood tides. Changes in lateral distribution also were attributable to moonlight. More shrimp were caught on the western side of the canal than on the eastern side during the full- and last-quarter-moon phases because the eastern side of the canal is in shadow for the early part of the ebb tide on these moon phases. On new and first-quarter moons the shrimp were usually distributed evenly across the center of the canal. (Auth.)

12320. Smith, Wesley E. (Fed. Water Pollution Control Admn., National Water Quality Lab., Duluth, Minnesota). 1970. TOLERANCE OF Mysis relicta TO THERMAL SHOCK AND LIGHT. Trans. Amer. Fish. Soc., 99(2): 418-422.

Tests were conducted to determine the thermal tolerance and effects of laboratory illumination on survival of Mysis relicta. Mysids were affected adversely by heat stress when temperatures rose above 10C. When acclimated to a temperature of 7.5C, this species had 96-hour median tolerance limits of 16 to 16.5C. Percent mortality was essentially the same when the animals were subjected immediately to test temperatures, as when temperatures were raised gradually from acclimation temperature over a period of 5 hours. When acclimated to a temperature of 4.5C and then subjected to temperature elevations of 1°, 2.5° and 5°C per day, 50% of the animals died at 16C in 16 days, 18C in 6 days and 16C in 4 days, respectively. It is suggested that Mysis relicta is an organism requiring considerable time for effective acclimation. Mysids were intolerant of exposure to normal laboratory illumination. The species lived satisfactorily in light of 10 hours a day for 2 weeks, but this period was followed by a steady mortality of about 8% of the original population per week. (Auth.)

12321. Kelso, John R. M., H. R. MacCrimmon, and D. J. Ecobichon (Univ. of Guelph, Guelph, Ontario, Canada). 1970. SEASONAL INSECTICIDE RESIDUE CHANGES IN TISSUES OF FISH FROM THE GRAND RIVER, ONTARIO. Trans. Amer. Fish. Soc., 99(2): 423-426.

An investigation was initiated to determine levels of insecticides in tissues of fish resident in areas of the Grand River watershed of southern Ontario. In general, chlorinated hydrocarbon residues were highest in the November collections and lowest in May or June. Tissues followed the same pattern of storage (highest DDD levels in liver, and lowest levels in dorsal muscle) during all samplings.

Dieldrin generally followed the same pattern as total DDT. Of the degradation products of DDT, p, p'-DDD was generally highest and p, p'-DDT was generally lowest in concentration. (Authors)

12322. Hogman, Walter J. (Center for Great Lakes Studies, Univ. of Wisconsin-Milwaukee, Milwaukee, Wisconsin). 1970. A COMPUTER PROGRAM FOR STOCK ANALYSIS IN FORTRAN IV, UNIVAC 1108. Trans. Amer. Fish. Soc., 99(2): 426-427.

This program computes common population parameters of multispecies stocks. There is no restriction on the number of individuals per species, localities of collection, number of different species, net types, ages, or other variables. The output is in three parts for each species or group. (Auth.)

12323. Moe, Martin A., Jr., Dale S. Beaumariage, and Robert W. Topp (Florida Dept. of Natural Resources, Marine Res. Lab., St. Petersburg, Florida). 1970. RETURN OF TAGGED GAG, Mycteroperca microlepis, AND CARIBBEAN RED SNAPPER, Lutjanus campechanus, AFTER SIX YEARS OF FREEDOM. Trans. Amer. Fish. Soc., 99(2): 428-429.

A gag was released with an internal anchor tag on 17 January 1963 in 33 m (18 fathoms) 250° from Longboat Pass, Sarasota. The fish measured 569 mm LS (670 mm TL) and weighed an estimated 8 pounds based on McErlean's (1963) length-weight curve. It was recaptured on 11 May 1969 by Mr. Carlton Raymond aboard the party boat "The Flying Fisherman" in 18 fathoms, 220° from Pass-a-Grille (off the Tampa Bay area) within 2 miles of the tagging site (latitude 27° 16' N, longitude 83° 09' W). It had been free 2, 307 days (6.3 years). The weight at recapture was reported as 35 pounds. An estimated recapture length of 870 mm SL was calculated from the relationship of otolith radius to standard length. The estimated growth increment of 301 mm indicated a growth rate of about 4 mm per month. One red snapper, 307 mm SL (370 mm TL), was tagged with an internal anchor and a dart tag on 25 July 1963. On 7 May 1969 (2, 114 days, 5.8 years, after tagging) this individual was caught by Captain John Tien aboard the M/V "Snapper Queen" in about 40 m (22 fathoms) at latitude 30° 44'N, longitude 80° 18' W, about 80 nautical miles NE (40°) from Matanzas Inlet. Only the total length, 30 inches (765 mm), was available upon final recapture. The increase of 395 mm indicated a growth rate of about 6 mm TL per month. These returns further illustrate the effectiveness of internal anchor tags for long-term tagging of reef fishes. (Authors)

12324. Andrews, Austin K. (Colorado Cooperative Fishery Unit, Colorado State Univ., Fort Collins, Colorado). 1970. SQUAMATION CHRONOLOGY OF THE FATHEAD MINNOW, Pimephales promelas. Trans. Amer. Fish. Soc., 99(2): 429-432.

The fathead minnow, Pimephales promelas, is presently being considered for intensive culture as a bait species in Colorado. As part of an investigation of the life history of this species the process of squamation was studied. No scales were observed on fathead minnows smaller than 14 mm. Average fish length (for all populations), at first scale deposition was 16.3 mm. Scalation begins in the center of the caudal peduncle and proceeds anteriorly and posteriorly along a line connecting the center of the caudal peduncle with the snout. Initial scales are not deposited along the decurved lateral line. As the first row of scales nears completion, additional rows of scales begin to form above and below. By the time the first row is completed, the second and third rows are well advanced. Rows of scales are added more rapidly ventrally than dorsally. The caudal peduncle is the first area to become completely scaled. All other scales are imbricated before the nape is scaled. All fish longer than 28 mm were completely scaled. (Auth.)

12325. Degraeve, G. M. (Great Lakes Fishery Lab., Bur. of Comm. Fisheries, Ann Arbor, Michigan). 1970. THREE TYPES OF BURROWING BEHAVIOR OF THE BROOK STICKLEBACK, Culaea inconstans. Trans. Amer. Fish. Soc., 99(2): p. 433.

While studying the social behavior of the brook stickleback (Cluaea inconstans) in Paint Creek, a small spring-fed creek in Washtenaw County, Michigan, the author observed three types of burrowing behavior. Brook sticklebacks, when frightened, often darted from the shallow lateral edges directly into the main stream leaving a small cloud of suspended silt behind them. It was subsequently discovered that many of these fleeing individuals actually emerged from the silt and when they terminated their high-speed flight some 4 to 6 feet up or downstream, they burrowed back into the silt by diving head first and rapidly lashing their tails to propel their bodies beneath the silt. Unless disturbed, the sticklebacks remained buried for periods exceeding 30 minutes. A second type of flight behavior was observed when some buried individuals, instead of bursting immediately from the silt when disturbed, "tunneled" through the silty substrate at about 0.5 feet per second for distances as great as 2 feet before emerging. A third type of burrowing behavior was apparently associated with feeding. On two occasions individuals were seen deliberately forcing their heads into the silt and rooting for food. (Auth.)

12326. Drummond, Robert A., and Walter F. Dawson (U. S. Dept. of Interior, Fed. Water Poll. Contr. Admn., National Water Quality Lab., Duluth, Minnesota). 1970. AN INEXPENSIVE METHOD FOR SIMULATING DIEL PATTERNS OF LIGHTING IN THE LABORATORY. Trans. Amer. Fish. Soc., 99(2): 434-435.

This paper describes a system of lighting control that can be fabricated easily, costs less than forty dollars, yet simulates sunrise and sunset at the beginning and end of the light period. (Authors)

12327. Zimmerman, Charles J. (Dept. of Zoology, Indiana Univ., Bloomington, Indiana). 1970. GROWTH AND FOOD OF THE BROOK SILVERSIDE, Labidesthes sicculus, IN INDIANA. Trans. Amer. Fish. Soc., 99(2): 435-438.

Brook silversides were studied at three locations: 1) Stephens Creek, 2) Lake Lemon, and 3) Monroe Reservoir. Lake Lemon silversides showed the fastest growth rate compared to those found in Stephens Creek which had the slowest rate; thus indicating that there may be a direct relationship between temperature and growth. Principal food items found in the stomachs of the brook silverside are: dance flies (Empididae) in Stephens Creek and chironomids in Lake Lemon and Monroe Reservoir. (Auth. conclusions)

12328. McIlwain, T. D. (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1970. STOMACH CONTENTS AND LENGTH-WEIGHT RELATIONSHIPS OF CHAIN PICKEREL (Esox niger) IN SOUTH MISSISSIPPI WATERS. Trans. Amer. Fish. Soc., 99(2): 439-440.

This report presents data on 108 Esox niger (301-565 mm) for the Mississippi Coastal Watershed. Food was found in 54% of 108 pickerel stomachs and, although 66 different organisms were eaten by 58 fish, only three stomachs contained more than one food item. The three dominant food items were largemouth bass (Micropterus salmoides, striped mullet (Mugil cephalus, and bluegill (Lepomis macrochirus). 38.8% of the identifiable fish were centrarchids. Thirty-nine percent of the food items were game fish. Length-weight data were combined in 2.4-centimeter total length classes and relationships between length and weight were determined by fitting the general length-weight equation $W = CL^n$ to the means of total length classes. The logarithmic form of the equation which best fits the length-weight relationship of Mississippi chain pickerel is $W = -7.0805 + 1.3937 \log L$, where W = weight in grams and L = total length in millimeters. (Auth.)

12329. Priegel, Gordon R. (Wisconsin Dept. of Natural Resources, Madison, Wisconsin). 1970. FOOD OF THE WHITE BASS, Roccus chrysops, IN LAKE WINNEBAGO, WISCONSIN. Trans. Amer. Fish. Soc., 99(2): 440-443.

The objective of this study was to determine the kinds of food consumed by white bass in Lake Winnebago. Young white bass in Lake Winnebago were plankton feeders. Daphnia was utilized by fish during each sampling period and occurred more frequently than any other organisms. Yearling and older white bass were plankton feeders relying especially on Daphnia and Leptodora. The smaller plankters, Cyclops and Diaptomus, although used by young white bass were not of any importance in the diet of older white bass. Chironomid pupae were an important item during the May-August period. Young forage fishes were consumed but were only of importance during a few sampling periods when these young fish were extremely abundant, and in most cases shortly after hatching. Of the fishes, trout-perch and freshwater drum occurred most frequently in white bass stomachs. (Auth.)

12330. Wellborn, Thomas L., Jr., and Robert D. Lindsey (Bur. of Sport Fish. and Wildl., Auburn Univ., Auburn, Alabama). 1970. OCCURRENCE OF ANCHOR PARASITES (Lernaea cyprinacea L.) ON ADULT BULLFROGS (Rana catesbeiana Shaw). Trans. Amer. Fish. Soc., 99(2): 443-444.

The anchor parasite, Lernaea cyprinacea L., is one of the serious ectoparasites that attack fish, particularly goldfish (Carassius auratus) and carp (Cyprinus carpio). They are also a serious problem of largemouth bass (Micropterus salmoides) and channel catfish (Ictalurus punctatus) in the southeastern United States. In August and September 1967, anchor parasites became a problem in two channel catfish broodstock ponds at the Tupelo National Fish Hatchery, Mississippi. Control, using Dylox, was initially effective but the fish rapidly became reinfested. Bullfrogs in the ponds were found to be infested with adult anchor parasites. They were identified as Lernaea cyprinacea L. It is possible that the bullfrog tadpoles became infested with anchor parasites and then retained them after metamorphosis, since all of the frogs examined had recently undergone metamorphosis. It is obvious that adult frogs infested with anchor parasites present a serious problem for fish hatcheries. The ease with which adult frogs can move from one pond to another will readily permit the spread of anchor parasites to every pond on a hatchery in a relatively short period of time. (Authors)

12331. Helle, John H. (Bur. of Comm. Fisheries Biological Lab., Auke Bay, Alaska). 1970. BIOLOGICAL CHARACTERISTICS OF INTERTIDAL AND FRESH-WATER SPAWNING PINK SALMON AT OLSEN CREEK, PRINCE WILLIAM SOUND, ALASKA, 1962-63. U. S. Dept. of Interior, U. S. Fish Wildl. Serv. Spec. Sci. Rep. Fish. No. 602, 19 p.

Prince William Sound is unique among major pink salmon-producing areas in that a significant portion of the spawning takes place in the intertidal zones of streams. Olsen Creek is one of the major spawning streams in the sound. The percentage of fines (solids passing through an 0.833-mm. sieve) in spawning-bed materials increased progressively from higher to lower intertidal levels, i.e., higher intertidal levels contained coarser spawning gravel than lower levels. Although less than one-third of the spawning area available in the Olsen Creek drainage is subject to tidal influence, 70 percent of the total pink salmon spawners occupied this area in 1962 and 30 percent in 1963. Late-run fish of the even-year line spawned only in the intertidal area; fish of both the early and late runs of the odd-year line spawned in both the intertidal and fresh-water areas. The size of the spawning populations was estimated by a repetitive stream survey technique, which is described and compared with the three methods used in 1960 and 1961. The length of pink salmon was compared between sexes, between spawning areas, and between times of spawning. Fish in the even-year line that spawned in the small intertidal creeks tended to be smaller than those that used the main stream, but in the odd-year line this difference was confined to females. The mean lengths of females were about the same in 1962 and 1963, but females from the odd-year line were more fecund. In both years a significant positive correlation was shown between lengths of females and numbers of eggs. (Auth.)

12332. Hudson, J. Harold, Donald M. Allen, and T. J. Costello (Bur. of Comm. Fisheries Tropical Atlantic Biological Lab., Miami, Florida). 1970. THE FLORA AND FAUNA OF A BASIN IN CENTRAL FLORIDA BAY. U. S. Dept. of Interior, U. S. Fish Wildl. Serv. Spec. Sci. Rep. Fish. No. 604, 14 p.

One hundred ninety-six species of plants and animals are reported from a nursery area for pink shrimp, Penaeus duorarum duorarum, in a basin of central Florida Bay. Many of the organisms are benthic and associated with shallow beds of turtle grass, Thalassia testudinum. Although abrupt habitat variations may affect species distribution, the general distribution of organisms in the basin and bay defines environments influenced by different water masses. (Authors)

12333. Schmitz, Eugene H., and Claude D. Baker (Dept. of Zoology, Univ. of Arkansas, Fayetteville, Arkansas). 1969. DIGESTIVE ANATOMY OF THE GIZZARD SHAD, Dorosoma cepedianum AND THE THREADFIN SHAD, D. petenense. Trans. Amer. Microsc.Soc., 88(4): 525-546.

The digestive anatomy of two cohabiting species, Dorosoma cepedianum (LeSueur) and D. petenense (Gunther), is described and a comparative functional morphological analysis is presented. The digestive systems of both species are adapted for microphagous habits. The pharynx is modified for the removal of microscopic particles and organisms from the water. It is hypothesized that the pharyngeal organs accumulate and consolidate food particles before they are released into the esophagus. The gizzard may be a secretory organ, as well as a mechanical organ that apparently functions in the rapid mixing of ingested food particles. The striking differences in gross morphologic features and length of the intestines are difficult to reconcile, the intestine of D. cepedianum having additional segments and being considerably longer in relation to body length. Available evidence suggests that the intestinal caeca may function in lipid absorption. (Authors)

12334. McDougal, H. D., and John D. Mizelle (Sacramento State College, Sacramento, California). 1969. STUDIES ON MONOGENETIC TREMATODES. XLIV. A NEW METHOD FOR COLLECTION OF MONOGENEA. Trans. Amer. Microsc. Soc., 88(3): 445-446.

In a current investigation involving fixation of gyrodactylids for ultramicrotome sectioning and production of electron micrographs, the use of formalin was contraindicated and freezing was also avoided because of rupture of cell structure by formation of ice crystals. Not having Chloretone on hand and also because of apprehension of its possible alteration of ultrastructure, manual shaking of live fish was attempted and resulted in the removal of many of the gyrodactylids present. Subsequently, a set of experiments was planned using an electrically driven Eberbach No. 6000 shaker. Maximum removal (76%) of Gyrodactylus alexanderi Mizelle & Kritsky, 1968, the only gyrodactylid present, was obtained in 8 min. Manual shaking for 2 min at approximately 200 cycles per minute removed 90% of G. alexanderi from samples of G. aculeatus. This method facilitates obtaining gyrodactylids for infestation and culture experiments. (Authors)

12335. Becker, C. Dale, and Max Katz (Pacific Northwest Lab., Battelle Mem. Inst., Richland, Washington). 1969. REFRACTIVE GRANULES IN Cryptobia salmositica, A HEMOFLAGELLATE OF FRESHWATER TELEOSTS. Trans. Amer. Microsc. Soc., 88(2): 300-304.

Recent studies on the incidence, distribution, and transmission of Cryptobia salmositica Katz 1951 (Kinetoplastida: Cryptobiidae) in freshwater teleosts of the Pacific Coast states disclosed refractive granules in the cytoplasm of parasites infecting two diverse hosts. This hemoflagellate has a broad host spectrum encompassing at least sixteen species of fish in four families. Yet, inclusions appeared only in parasites associated with riffle sculpins, Cottus gulosus (Cottidae), and longnosed dace, Rhinichthys cataractae (Cyprinidae). Subsequent observations were made in Spade Creek, a tributary of the Green River (King County), Washington. Smears of peripheral blood were prepared from ten riffle sculpins and five torrent sculpins, Cottus rhotheus, each month for 11 months. Parasitemias

were detected in 70 of 110 riffle sculpins and about 98% of the flagellates contained refractive granules. None of the organisms infecting 42 of 55 torrent sculpins from the same environs contained granules. (Authors)

12336. Johnson, Sterling K. (Fisheries Lab., Agricultural Experiment Station, Auburn Univ., Auburn, Alabama). 1969. SODIUM HYPOCHLORITE: USE ON PARASITIC COPEPODA FOR IDENTIFICATION. Trans. Amer. Microsc. Soc., 88(4): 591-592.

Sodium hypochlorite (obtainable commercially as Clorox or other products) is useful for removal of soft tissues of copepods or other invertebrate forms prior to laboratory identification. Formalin preserved specimens may be directly placed in about a 5% solution for 1 to 3 minutes followed by a distilled water rinse and then staining and mounting. (Auth.)

12337. Wood, C. E., and T. L. Sheddan (Tennessee Valley Authority, Norris. Fish and Wildlife Branch, Tennessee). 1968. EFFECTS OF FERTILIZER ON FOOD CHAIN ORGANISMS AND FISH PRODUCTION IN NORRIS RESERVOIR, TENNESSEE). Tennessee Valley Auth., Fish and Wildl. Branch publication, 19 p.; Selected Water Resources Abstracts, 3(9): p. 10, 1970.

Six coves of Norris Reservoir were treated with fertilizer (monoammonium phosphate and ammonium sulfate) in order to (1) ascertain effects of fertilizer on production of game fish and fish food organisms and (2) determine the practibility of fertilization for improvement of game fish production in specific areas. Coves were fertilized at rates of 100 and 50 micrograms/liter nitrogen and 50 and 25 micrograms/liter phosphorus; 2 coves served as controls. Three zooplankton blooms were noted following fertilization, one coinciding with increasing temperature and one coinciding with increased rainfall and surface runoff. Rotifers were most numerous in all coves, copepods and cladocerans were of secondary importance among the zooplankton. Tendiped larvae dominated benthic fauna; tubificids and midge larvae (Ceratopogonidae) contributed important numbers. Benthic fauna were significantly more abundant in coves exposed to lower fertilizer levels. Forage fish dominated samples; no numerical increase of game fish was noted. Amount of fertilizer lost through sinking and flushing was not determined. Graphical and tabular data include hydrography, chemical analyses, and biological analyses of samples from all coves. -- Voigtlander

12338. Hilsenhoff, William L., and Richard P. Narf (Dept. of Entomology, Wisconsin Univ., Madison, Wisconsin). 1968. ECOLOGY OF CHIRONOMIDAE, CHAOBORIDAE, AND OTHER BENTHOS IN FOURTEEN WISCONSIN LAKES. Annals of the Entomological Soc. of America, 61(5): 1173-1181; Selected Water Resources Abstracts, 3(9): p. 11, 1970.

Benthos ecology in the profundal zones of 14 Wisconsin lakes was studied for three years. Chironomid larvae were reared to the imago for identification, and a key to species of Chironomus larvae constructed. Populations of 10 species of Chironomus, Procladius, three species of Chaoborus, Palpomyia, Ostracoda, and Copepoda were determined from monthly samples and correlated with 14 physical and chemical characteristics to determine possible relationships. Chironomus plumosus (L), Procladius larvae, and Ostracoda occurred in the same lakes, and this incidence was positively correlated with a high pH of the mud and negatively related with the amount of organic matter in mud. Presence of C. attenuatus Walker and Palpomyia larvae was correlated with clear water. Chironomus 'A', C. staegeri Lundbeck, and Chironomus 'C' were most common in the same lake. Chaoborus punctipennis (Say) larvae were frequent in lakes forming a summer thermocline, and Copepoda were abundant in the most eutrophic lakes. Details on species occurrence are given, with notes on rarer insects in the profundal zones. The third most plentiful insect family in the profundal mud was Ceratopogonidae. -- Jones

12339. Howells, Gwyneth Parry, Theo. J. Kneipe, and Merril Eisenbud (Inst. for Environmental Medicine, New York, N. Y.). 1970. WATER QUALITY IN INDUSTRIAL AREAS: PROFILE OF A RIVER. Environmental Science and Technology, 4(1): 26-35.

The lower Hudson, like most tidal areas, must serve many needs, and its biological status is a direct measure of its ability to do so. Potential eutrophic nuisance species of algae are present in the river, and the shores are populated by animals indicative of sewage pollution. Serious fouling and deoxygenation have so far been avoided for most of the river. Heat additions are a major concern; the capacity of the river as a heat sink is severely limited during the peak summer demand by a low net flow and high ambient air temperatures. There is need for studies of species endemic to the river to determine their response, singly and together, to changes in temperature. -- Robert M. Howland

12340. Behrisch, Hans W. (Dept of Zoology, Univ. of British Columbia, Vancouver, B. C., Canada). 1969. TEMPERATURE AND THE REGULATION OF ENZYME ACTIVITY IN POIKILOTHERMS. FRUCTOSE DIPHOSPHATASE FROM MIGRATING SALMON. Biochem. J., 115(4): 687-696.

The calculated energy charge of the liver cell from migrating salmon is very low (0.464), in keeping with the extended starvation and high rates of muscular and biosynthetic activity of these organisms. Affinity of fructose 1, 6-diphosphatase for substrate increases with a decrease in temperature. Arrhenius plots of the saturation kinetics are complex and suggest an interconversion of one or more forms of the enzyme; this interconversion is dependent on the identity of the co-factor. Affinity of salmon fructose 1, 6-diphosphatase for its allosteric inhibitor (AMP) is lower than in other fructose 1, 6-diphosphatases and this enzyme - AMP interaction is largely insensitive to temperature. The functional significance of diminished AMP sensitivity is that it allows normal or high fructose 1, 6-diphosphatase activity;during a low energy charge. These findings suggest mechanisms for the maintenance of high rates of gluconeogenesis in salmon during spawning migration. (Auth.)

12341. Malone, C. R., and B. G. Blaylock (Radiation Ecology Section, Health Physics Div., Oak Ridge National Lab., Oak Ridge, Tennessee). 1970. TOXICITY OF INSECTICIDE FORMULATIONS TO CARP EMBRYOS REARED in vitro. J. Wildlife Mgmt., 34(2): 460-463.

Carp (Cyprinus carpio) eggs stripped and fertilized in vitro were subjected to commercial formulations of DDT, chlordane, dieldrin, endrin, diazinon, and Guthion® at concentrations of 0.001, 0.01, 0.10, 1.0, 5.0, and 10.0 ppm active ingredients. None of the chemicals significantly affected embryo viability at concentrations <1 ppm, but all six resulted in about 50-100 percent mortality at 5 ppm. Chlordane at concentrations of <1 ppm stimulated embryo development and reduced incubation time by about one-third. (Authors)

12342. Gulland, J. A. (Fisheries Dept., FAO, Rome, Italy). 1968. THE CONCEPT OF THE MARGINAL YIELD FROM EXPLOITED FISH STOCKS. J. Cons., 32(2): 256-269.

When increasing fishing effort is applied to an exploited stock, the increase in total yield (the marginal yield) is less than might be estimated from the product of the increase in effort and the catch-per-unit-effort. The marginal deficiency, defined as the percentage that the actual increase is of the expected increase, decreases from near 100% for very lightly fished stocks to near zero or even negative for heavily fished stocks. The precise form of the marginal efficiency as a function of the catch is examined for two of the commonly used population models. The implication of the concepts of marginal yield and marginal efficiency for fisheries management, and the planning of fisheries development are discussed. (Auth.)

12343. Kutty, M. Krishnan, and S. Z. Qasim (Biological Oceanography Div., National Inst. of Oceanography, Ernakulam, S. India). 1968. THE ESTIMATION OF OPTIMUM AGE OF EXPLOITATION AND POTENTIAL YIELD IN FISH POPULATIONS. J. Cons., 32(2): 249-255.

Some methods for estimating the optimum age (t_y) and the potential yield (Y) in fish populations have been described under allometric and isometric conditions of growth. The relative constancy of t_y and Y under all conditions of exploitation indicates that these parameters, in the absence of a long series of data, could be used for measuring the fishing efficiency. (Authors)

12344. Smith, S. Wiedemann (The Danish Inst. for Fishery- and Marine Research, Charlottenlund, Denmark). 1968. OTOLITH AGE READING BY MEANS OF SURFACE STRUCTURE EXAMINATION. J. Cons., 32(2): 270-277.

Surface microscopy (as used in metallography) shows the finer structure in the otolith and often clearly reveals annual rings, even in older fish. Measurements are easily made on specimens or on photographs. Examination of the flat, polished, surface of the otolith reveals a pattern of concentric lamellae of different thickness. Groups of thin lamellae often form rings which correspond to the dark year rings in a burned otolith. With surface illumination such rings can be found in otoliths which could not otherwise be read. The technique of embedding, cutting and illuminating otoliths for surface microscopy is described. (Auth.)

12345. Nakatsukasa, Yasuo. 1968. STUDIES ON THE POLYMORPHIC SARCOMA FOUND IN A CHUM SALMON, Oncorhynchus keta (Walbaum). Jap. J. Ichthyol., 15(1): 7-10, (In Japanese with English summ.)

The author made a histological study of a tumor which grew in the muscular tissue of the lateral wall of the abdominal cavity of a chum salmon. The cells in the tumor were round, oval, or spindle-shaped. From observations it was considered that the tumor developed in muscular tissue and grew into the kidney tissue with infiltrative growth. There was no clear difference between parenchyma and stroma in the tumor, which was then considered to be non-epithelial. The study suggested the tumor as a polymorphic-cell sarcoma. (Auth. summ.)

12346. Silliman, Ralph P. (Bur. of Comm. Fisheries Biological Lab., Seattle, Washington). 1966. ANALOG COMPUTER MODELS OF FISH POPULATIONS. Bur. of Comm. Fisheries, Fish. Bull., U.S., 66(1): 31-46.

A modern analog computer, together with an X-Y plotter, provides a means of constructing useful models of commercially exploited fish populations. The model combined conventional exponential fishing and natural mortality rates with a Gompertz curve of growth in weight. By combination of these rates and curve into a single differential equation, survival curves for successive year classes of fish were generated by the computer and plotted by the plotter. Weights for all year classes present in each season were summed graphically. Recruitment was determined from a stock-recruitment curve, set into a function generator of the computer. Yields for each season were calculated by multiplying stock weight by rate of exploitation and were compared with actual yields to test the validity of the models. The technique was demonstrated by use of empirical and hypothetical data for the Atlantic cod (Gadus morhua). It is generally applicable to fisheries for which good measures of total catch, growth rate, natural and fishing mortality rates, and stock-recruitment relation are available. It is important to use reasonable values of biological variables in constructing the models because it was not possible to demonstrate beyond doubt that the set of parameters for any given model provides a unique solution. Compared with other techniques, the analog-graphic approach offers low cost of equipment, moderate computation speed, ready accessibility of equipment, and good visibility of results during computation. It is limited in accuracy (two or three digits) and in scaling requirements. (Auth.)

12347. Cumming, Kenneth B., and R. Don Estes (Virginia Polytechnic Inst., Blacksburg, Virginia). 1969. SOME WATER QUALITY ASPECTS OF THE UPPER ROANOKE RIVER BASIN WITH SPECIAL EMPHASIS ON TEMPERATURE. Virginia Polytechnic Inst. Water Resources Research Center Bull. No. 23, 66 p.; Selected Water Resources Abstracts, 3(9): p. 31, 1970.

A study was undertaken by the Virginia Cooperative Fishery Unit on the effects of the Smith Mountain pumped storage project. The study documents some of the before and after water quality features of the Roanoke River in the area of the pumped storage operation. Until now, there has been only a limited amount of data and little evaluation of the effects of such projects upon downstream water quality. While emphasis has been placed on water temperature regimes above, in, and below the project, there is considerable information on water chemistry and some of the operating dynamics which affect water quality. The research is of particular interest because downstream water quality could affect the resident striped bass population of Kerr Reservoir. There appears to be a trend toward deepening of the summer epilimnion since 1965. The schedule of water releases has substantially changed the flow pattern in the river without altering the average volume of discharged water. This variable flow has led to variable temperatures on a weekly basis and there is inferred a variable water chemistry because of the low flow during weekends. Temperature profiles are plotted and the data used to construct them are tabulated. -- Knapp

12348. Jensen, Albert C. (Div. of Marine and Coastal Resources, New York State Dept. of Conservation, Albany, New York). 1969. FISH AND POWER PLANTS. The Conservationist, N. Y. State Conservation Dept., 24(3): 2-5; Selected Water Resources Abstracts, 3(9): p. 31, 1970.

A biological survey was made to predict the effects of the proposed Storm King Mountain pumped storage hydroelectric plant on the ecology of the Hudson River Estuary. Large numbers of eggs, larvae, and young striped bass would be withdrawn by the proposed hydroelectric plant. However, the eggs and young fish that would be withdrawn would be but a small percentage of the total number of each of the life stages of striped bass present in the estuary. Approximately 2.8% would be subject to withdrawal. Substantial numbers of blueback herring, alewife, tomcod and white perch, small enough to pass through the screens, also would be withdrawn seasonally but that because of the varying distribution of the species in the estuary, the effect of losses by the operation of the plant probably would be minimal. Operations of additional plants — power, manufacturing or other — that require large volumes of water could, in combination with the proposed Cornwall plant, destroy sufficient numbers of eggs and larvae of fishes to adversely affect subsequent populations. These effects could be particularly severe if the plants were built in areas of heavy fish concentrations. The proposed pump-storage hydroelectric plant at Cornwall would not have a significant adverse effect on the populations of striped bass and shad in the Hudson River. -- Knapp

12349. Bender, Michael (Dept. of Environmental Health, Michigan Univ., Ann Arbor, Michigan). 1969. THE TOXICITY OF THE HYDROLYSIS AND BREAKDOWN PRODUCTS OF MALATHION TO THE FATHEAD MINNOW (Pimephales promelas, Rafinesque). Water Research, Vol. 3, pp. 571-582; Selected Water Resources Abstracts, 3(9): p. 35, 1970.

Malathion undergoes hydrolysis in aqueous basic solutions to diethyl fumarate and DMPTA. The toxicity of the products of malathion hydrolysis in the fathead minnow, Pimephales promelas, were evaluated. The studies were conducted by toxicity bioassays of 96 hr duration and continuous exposure test of 14 day duration. The results of the experiments demonstrated the following: (1) the basic hydrolysis product, diethyl/fumurate, was more toxic than malathion to the test species; (2) a pronounced synergistic effect was demonstrated between malathion and its two basic hydrolysis products; and (3) continuous exposure decreased the TLm concentration of malathion and its basic hydrolysis products. -- Sjolseth

12350. Macek, Kenneth J., Curt Hutchinson, and Oliver B. Cope (Fish-Pesticide Lab., Bur. of Sport Fisheries and Wildlife, Columbia, Missouri). 1969. THE EFFECTS OF TEMPERATURE ON THE SUSCEPTIBILITY OF BLUEGILLS AND RAINBOW TROUT TO SELECTED PESTICIDES. Bull. of Environmental Contamination and Toxicology, 4(3): 174-183; Selected Water Resources Abstracts, 3(9): p. 36, 1970.

The median tolerance limits to 15 pesticides were calculated for 24 and 96 hours of exposure at 1.6°, 7.2°, and 12.7°C for rainbow trout and at 12.7°, 18.3°, and 23.8°C for bluegills. The pesticides tested were aldrin, chlordane, naled, dieldrin, diuron, Dursban, endrin, azinphosmethyl, heptachlor, lindane, malathion, methoxychlor, endosulfan, toxaphen, and trifluralin. There was generally an increase in the susceptibility of fish to most pesticides tested as temperature increased. The authors feel this increased susceptibility to be due to an increased level of enzymatic activity and possibly to the effect of temperature on metabolism. The authors stressed the need for considering factors when determining safe levels in aquatic habitats. -- Sjolseth

12351. Andrews, C. W. (Toronto Univ., Ontario, Canada). 1946. EFFECT OF HEAT ON THE LIGHT BEHAVIOUR OF FISH. Trans. Royal Soc. of Canada, Section V, pp. 27-31; Selected Water Resources Abstracts, 3(9): p. 38, 1970.

The effect of heat on the light behaviour of the common sucker (Catostomus commersoni) has been studied. Two-year-old suckers were found to be negatively phototactic at depths of 8 and 12 inches, while they were positively phototactic at 16 inches or more depth. All sizes tested were found to become insensitive to light at temperatures less than lethal and they regained light sensitivity if the temperatures were lowered again. The temperature of insensitivity to light decreased with increased age. The temperature of insensitivity to light varied directly with temperature of acclimation, increasing from 20.3°C to 32.5°C for acclimation temperatures of 5°C to 22°C respectively, for light of constant intensity, increasing from 10.5°C to 20.5°C for relative light intensities of 1 and 1000 respectively. -- Speakman

12352. Alabaster, J. S. (Salmon and Freshwater Fisheries, Ministry of Agriculture, Fisheries and Food, London, England). 1969. SURVIVAL OF FISH IN 164 HERBICIDES, INSECTICIDES, FUNGICIDES, WETTING AGENTS AND MISCELLANEOUS SUBSTANCES. International Pest Control, 2(2): 29-35; Selected Water Resources Abstracts, 3(9): p. 38, 1970.

Tests by the Salmon and Freshwater Fisheries Laboratory in London were conducted to measure the toxicity of 164 pesticides to fish. Harlequin fish (Rasbora heteromorpha), rainbow trout, brown trout and plaice were the test fish. The 24 and 48-hour median lethal concentrations, together with the estimated mean threshold values (concentration at which 50% of the fish would be killed in 3 months) are given for herbicides, fungicides, insecticides, excluding DDT and sheep dips, wetting agents and miscellaneous substances. In general the relationship between the logarithm of survival time and the logarithm of material concentration is non-linear, often indicating a threshold concentration for survival. The results suggest it is essential to test actual pesticide as sold rather than rely on figures available for the toxicity of the ingredients. In only very few cases was the toxicity of a formulated compound dependent simply on the amount of active ingredient. -- Sjolseth

12353. McKay, Charles R., and David Jay Hartzband (Systematics-Ecology Program, Marine Biological Lab., Woods Hole, Massachusetts). 1970. PROPYLENE PHENOXETOL: NARCOTIC AGENT FOR UNSORTED BENTHIC INVERTEBRATES. Trans. Amer. Microsc. Soc., 89(1): 53-54.

Low concentrations of propylene phenoxetol (0.15%) in sea water will narcotize benthic invertebrates of several phyla quickly and with a minimum of morphological damage. (Authors)

12354. Garey, Walter (Physiology Dept., State Univ. of New York at Buffalo, Buffalo, New York). 1970. CARDIAC OUTPUT OF THE CARP (Cyprinus carpio). Comp. Biochem. Physiol., 33(1): 181-189.

A cardiac output of 18.3 ml/min per kg (SE 1.87) was determined by the Fick principle for resting Cyprinus carpio at 10°C. Gill blood flow seems to be directly related to the total oxygen consumption. It is suggested that the cardiac output decreases when the O_2 tension of the ambient water falls below a critical level and increases as the fish becomes anemic. Cardiac work in resting carp requires about five percent of the energy production. (Auth.)

12355. Chavin, Walter, and Jack E. Young (Dept. of Biology, Wayne State Univ., Detroit, Michigan). 1970. FACTORS IN THE DETERMINATION OF NORMAL SERUM GLUCOSE LEVELS OF GOLDFISH, Carassius auratus L. Comp. Biochem. Physiol., 33(3): 629-653.

Aquarium transfer produced a significant hyperglycemia of 2-day duration. "Asphyxiation" hyperglycemia occurred 15 min after removal from water. Differences in serum glucose of goldfish weighing 1.5-7.1 g were not present, but fish weighing less than 1.5 g were significantly higher. No serum glucose difference occurred among well-acclimated goldfish (a) rapidly captured in various ways, (b) differing in phenotype, (c) sacrificed hourly during the photoperiod, (d) fed various amounts of food or (e) fasted to 151 days. Serum glucose of 300 normal goldfish ranged from 12.9 to 91.4 mg/100 ml; the mean was 28.5 mg/100 (S.D. $\pm$ 9.6; S.E. $\pm$ 0.56). (Authors)

12356. Waks, Miriam D., and Roderick A. Westerman (Dept. of Physiology, Monash Univ., Clayton, Victoria 3168, Australia). 1970. INHIBITION OF PURKINJE CELLS IN THE CEREBELLUM OF THE TELEOST Salmo gairdneri Richardson. Comp. Biochem. Physiol., 33(2): 465-469.

Electrical activity of single Purkinje cells (P-cells) in rainbow trout cerebellum was recorded extracellularly. Poststimulus-time histograms of the giant spike response to spinal cord or cerebellar surface stimulation revealed an initial period of inhibition (30-150 msec duration) succeeded by a marked facilitation which was in turn often followed by a second inhibitory period. It was concluded that there are functional inhibitory interneuronal-Purkinje cell connections in this species and that feedback of P-cells onto inhibitory elements within the cerebellum may also occur. (Authors)

12357. Hashimoto, Toru, Yasuji Katsuki, and Keiji Yanagisawa (Dept. of Physiology, Tokyo Medical and Dental Univ., Yushima, Bunkyo-ku, Tokyo, Japan). 1970. EFFERENT SYSTEM OF LATERAL-LINE ORGAN OF FISH. Comp. Biochem. Physiol., 33(2): 405-421.

The efferent feedback system of the lateral-line organ of a fish, Japanese sea eel, was confirmed electrophysiologically by the following observations. An inhibitory effect to the afferent neural activity is caused by the descending electrical stimulation of the lateral-line nerve. The descending spontaneous activity of the lateral-line nerve is responsive to the mechanical stimulation of the contralateral or ipsilateral intact end organs. The efferent system might adjust the sensitivity of the receptor to various environmental conditions. The crossed efferent might also play an important role in identifying the stimulus location in the environmental free space. (Authors)

12358. Clark, Frank H. (Morris Harvey College, Charleston, West Virginia). 1970. PLEIOTROPIC EFFECTS OF THE GENE FOR GOLDEN COLOR IN RAINBOW TROUT. J. Hered., 61(1): 8-10.

It is suggested that the gene for golden color in the rainbow trout, Salmo gairdneri, causes such fish to be noticeably less active than the wild-type rainbow. They are also very sensitive to light (negative phototaxic), and were smaller in size than normal fish before this was corrected by selection. The gene for golden color may have other effects upon the fish than those described here. (Auth. summ.)

12359. Fenwick, James C. (Dept. of Zoology, Univ. of British Columbia, Vancouver 8, British Columbia, Canada). 1970. BRAIN SEROTONIN AND SWIMMING ACTIVITY IN THE GOLDFISH, Carassius auratus. Comp. Biochem. Physiol., 32(4): 803-806.

Bilaterally enucleated goldfish have lower brain serotonin (5-hydroxytryptamine or 5-HT) levels and exhibit more spontaneous swimming activity than animals with intact lateral vision. It is suggested that this negative correlation between brain 5-HT levels and locomotory activity may not be fortuitous; that is, the level of brain 5-HT may be related functionally to the occurrence of spontaneous swimming activity. (Auth.)

12360. McNabb, Roger A., and Grace E. Pickford (Bingham Lab., Dept. of Biology, Yale Univ., New Haven, Connecticut). 1970. THYROID FUNCTION IN MALE KILLIFISH, Fundulus heteroclitus, ADAPTED TO HIGH AND LOW TEMPERATURES AND TO FRESH WATER AND SEA WATER. Comp. Biochem. Physiol., 33(4): 783-792.

Adult male killifish, F. heteroclitus, were acclimated for 5 weeks to fresh water and sea water at 20 and 28°C. Estimates of thyroid activity were made from thyroid cell height, colloid staining properties, the rate of loss of thyroidal I^{131} and serum concentrations of BEI^{131}. Results indicate that the levels of activity follow the sequence: FW20 FW28 SW20 SW28. Some of the possible interactions of salinity and temperature are discussed. (Authors).

12361. Anderson, Thomas R. (Dept. of Physiology and Biophysics, Univ. of Illinois, Urbana, Illinois). 1970. TEMPERATURE ADAPTATION AND THE PHOSPHOLIPIDS OF MEMBRANES IN GOLDFISH (Carassius auratus). Comp. Biochem. Physiol., 33(3): 663-687.

No major differences were found in the relative concentrations of various phosphatides in tissues of 5°C- and 25°C-adapted goldfish. Greater incorporation of ^{14}C-acetate into the phosphatides of 5°C- than of 25°C-adapted fish tissues occurred and varied with the phosphatide. It is suggested that the non-uniform incorporation was due in part to different phosphatide turnover rates and in part to acyltransferase activity, especially in the gill. The phosphatides of liver and the PC and "PI" of gill all showed greater turnover in 5°C-adapted fish as measured by ^{32}Pi incorporation. However, gill PE and CL showed greater turnover in 25°C-adapted fish. These differences may be due to enzyme specificity for the fatty acid moieties of the precursor molecules. Temperature acclimation markedly influenced the turnovers of gill PC and PE and liver PC and "PI". Cold temperature acclimation influenced the incorporation of ^{14}C into gill-PC more than into liver-PC, and ^{32}Pi into liver-PC more than into gill-PC. The effect of temperature acclimation remained after systemic influences were removed as shown by comparing the in vivo and in vitro data. Transport of the isotopes into brain tissue was poor, especially for ^{32}Pi where negligible incorporation occurred during 48 hr. (Auth.)

12362. Overstreet, Robin M. (Dept. of Parasitology, Tulane Univ., School of Public Health and Tropical Medicine, New Orleans, Louisiana). 1970. Spinitectus beaveri sp. n. (NEMATODA: SPIRUROIDEA) FROM THE BONEFISH, Albula vulpes (Linnaeus), IN FLORIDA. J. Parasit. 56(1): 128-130.

Spinitectus beaveri sp. n. from the stomach of Albula vulpes is described. In the male, the maximum length is 6 mm, the esophagus is approximately 30% of the body length, the spicule ratio is 1:2.5 to 3.0, and there are 4 pre- and 5 postcloacal papillae. In the female, the maximum length is 7 mm, the esophagus is approximately 27% of the body length, and approximately 38% of the body length is posterior to the vulva. The species most closely resembles S. carolini Holl, 1928, from which it differs by having 10 to 16 rather than 25 to 35 cuticular spines per transverse row and a complex rather than a plain distal portion of the left spicule. (Auth.)

12363. Silliman, Ralph P. (Bur. of Comm. Fisheries Biological Lab., Seattle, Washington). 1968. INTERACTION OF FOOD LEVEL AND EXPLOITATION IN EXPERIMENTAL FISH POPULATIONS. USFWS, BCF, Bull. 66(2): 425-439.

Nine populations of guppies (Lebistes reticulatus) were established in separate aquariums. Food supply was constant for groups of three populations in ratios of 0.5, 1.0, and 1.5 to a "standard" diet. Temperature, light, and space were constant and the same for all populations. After 28 weeks, populations had reached near-asymptotic levels, and mean numbers and weights for each group of three were in the same rank as their food levels. Twenty-five percent, 33 percent, and 50 percent of the fish were removed per 3-week brood interval for each food-level group of three populations, thus providing nine combinations. Continuation of exploitation at these rates led to relatively stable yields during weeks 59 to 72, after initial declines due to readjustment of populations. Yield curves for each food level revealed relation of yield to exploitation rate and biomass to be independent of amount of food consumed. Maximum yields occurred near the 0.33 (33 percent) exploitation rate for all food levels and represented about 25 percent of the food consumed. Results suggest that if commercially fished populations behave as the experimental ones did, management strategies may be applied independently of amount of food organisms available. (Auth.)

12364. Goodyear, C. Phillip (Savannah River Ecology Lab., U. S. Atomic Energy Comm., Aiken, South Carolina). 1970. TERRESTRIAL AND AQUATIC ORIENTATION IN THE STARHEAD TOPMINNOW, Fundulus notti. Science, 168(3931): 603-605.

Starhead topminnows from various shores of a small woodland pond were displaced to unfamiliar surroundings, and their orientation was tested in aquatic and terrestrial arenas. These fish used a sun compass to move in a direction which, at the location of their capture, would have returned them to the land-water interface. The fish accomplished directional terrestrial locomotion by using the position of the sun to align its body for each jump. On heavily overcast days many fish were unable to orient their bodies to a consistent direction from jump to jump; this inability to orient resulted in random rather than linear movement. There was considerable individual variation in terrestrial locomotor ability. (Auth.)

12365. Utter, Fred M., and George J. Ridgway (Bur. of Comm. Fisheries Biological Lab., Seattle, Washington). 1967. CROSS-REACTIVE PROPERTIES OF ANTISERA PREPARED IN RABBITS BY STIMULATIONS WITH TELEOST VITELLINS. USFWS, BCF, Bull. 66(2): 203-207.

Antisera were prepared by injecting rabbits with egg or serum vitellin preparations from seven teleost species belonging to different families. The ranges of reactivity of these antisera were tested with sera from mature females of nine teleost families as well as with sera from females of spiny dogfish, Pacific lamprey, and white sturgeon. All of these antisera reacted with vitellins from all species tested from the homologous families. Antisera prepared against rockfish and flounder vitellins cross-reacted with sera from mature females of all teleost species tested. A greater antigenic complexity in the vitellins of more taxonomically advanced species than more primitive species is indicated by the results of the reactions and absorption tests. The results are of practical importance in studies on maturity of fishes and have theoretical implications in the field of systematics. (Authors)

12366. Burnet, A. M. R. (Fisheries Lab., Marine Dept., Christchurch, New Zealand). 1969. TERRITORIAL BEHAVIOUR IN BROWN TROUT (Salmo trutta L.) N. Z. J. mar. Freshwat. Res., 3(3): 385-388.

The recapture of tagged brown trout (Salmo trutta L.) in two experimental streams gave over 60% recapture in the section of stream where they were released, and over 80% when adjacent areas were included. Operation of a downstream trap showed that there was little emigration from the area above the trap and it is concluded that most of the fish which disappear die. (Auth.)

12367. McAlister, W. Bruce (Bur. of Comm. Fisheries Biological Lab., Seattle, Washington). BUOY TELEMETRY FOR ENVIRONMENT PREDICTION IN FISHERIES RESEARCH. Proc. Int. Telemetering Conf., Los Angeles, Calif., Oct. 8-11, 1968, Vol. 4, pp. 650-657.

A telemetering buoy has been developed for the Bureau of Commercial Fisheries to provide environmental information in support of salmon research. The buoys are designed to be free-drifting units; sensors are inductively coupled to a 200 m. single conductor cable beneath the buoy. Present sensors measure temperature, conductivity and depth. One buoy is equipped to participate in the IRLS satellite telemetry experiment. Present development includes equipment to have the buoys determine their position by use of the U. S. Navy Navigation Satellite System. (Auth.)

12368. Nakatani, R. E. (Battelle Memorial Inst., Richland, Washington). 1968. BIOLOGICAL EFFECTS OF HANFORD HEAT ON COLUMBIA RIVER FISHES - A REVIEW. U. S. Atomic Energy Comm., BNWL-SA-1682, 24 p.; Selected Water Resources Abstracts, 3(10): p. 30, 1970.

To obtain information on the effects of heated discharges from the reactors at Hanford, Washington, on fish in the Columbia River, the temperature tolerance of young chinook salmon exposed to 7 different temperatures was investigated; the lowest temperature was similar to the average river temperature at Priest Rapids dam, and it was found that increased temperature resulted in increased body weight. Adult salmon and steelhead trout were fitted with sonic tags so that their behavior in the vicinity of the waste-water plumes could be detected; the results showed no evidence of a temperature block, but the fish tended to migrate upstream along the opposite bank from the reactor sites. -- Rietveld

12369. Brezina, E. R., Robert S. Campbell, and James R. Whitley (Missouri Univ., Dept. of Zoology, Columbia, Missouri). 1970. THERMAL DISCHARGE AND WATER QUALITY IN A 1,500-ACRE RESERVOIR. J. Wat. Poll. Contr. Fed., 42(1): 24-32; Selected Water Resources Abstracts, 3(10): p. 31, 1970.

This study reports on the effects of thermal discharges from a 525,000-kw fossil-fueled steam-electric plant into a 4.5 billion gal reservoir with a mean depth of 8.2 ft. in central Missouri. The most significant effect observed during the 21-month study was temperature elevation which averaged 5° to 8°C with a maximum difference in mean temperatures of 10°C. Differences in DO were always less than 1 mg/l. The area heated by the thermal discharge is influenced by the direction of the prevailing wind. The relatively shallow depth of the reservoir with the wind effects minimizes with thermal stratification and maintains suspension of fine particles. Runoff water maintains the high level of turbidity in the reservoir. There was no significant difference in living matter present in the heated and unheated areas of the reservoir. -- Knapp

12370. Edmundson, Eldon, Jr., Vincent Schultz, and Alfred W. Klement, Jr. (Washington State Univ., Pullman, Washington). 1969. MARINE RADIOECOLOGY. U. S. Atomic Energy Comm., Div. of Technical Information, TID-3917, Biology and Medicine (TID-4500), 127 p.; Selected Water Resources Abstracts, 3(10): p. 32, 1970.

Interest continues to grow in marine radioecology, a diverse and widely ranging subject, about which literature is relatively extensive and scattered. It is believed that this bibliography of 1450 entries includes most major non-Russian publications, other than progress reports in the field. Dates of publication of documents cited span the period 1908-1969, with approximately 59% dated 1960 or later. The Japanese literature is extensively covered. Additional foreign-language coverage includes Italian, French, German, Finnish, Chinese, and Korean. -- Eichhorn

12371. U. S. Dept. of the Interior, Bur. of Sport Fisheries and Wildlife. 1970. FEDERAL AID IN FISH AND WILDLIFE RESTORATION 1969. Published by Wildlife Management Inst. and Sport Fishing Inst., Washington, D. C., 103 p., Illus.

12372. Vibert, R. 1970. FISHING WITH ELECTRICITY: ITS APPLICATION TO BIOLOGY AND MANAGEMENT. Int. Marine Publishing Co., Camden, Maine (n. d.), 304 pp. $12.50; National Fisherman, 50(11), S3, March 1970; Commercial Fisheries Abstracts, 23(5): p. 6, 1970.

This book is a collection of reports (given at an international meeting on electric fishing held in Belgrade, Yugoslavia, in 1966) written by electrical engineers, biologists, and technicians. It summarizes the status of electric fishing in fresh water and reviews the basic research that has been done in the field. -- L. Baldwin

12373. Tackett, Stanford L., and Margaret A. Brocious (Dept. of Chemistry, Indiana Univ. of Pennsylvania, Indiana, Pennsylvania). 1969. X-RAY FLUORESCENCE DETERMINATION OF IRON IN POLLUTED STREAMS. Analytical Letters, 2(12): 649-655; Commercial Fisheries Abstracts, 23(5): p. 20, 1970.

Water discharged into streams from mining and industrial operations is frequently polluted with iron. The method of analysis proposed for the determination of iron in polluted streams involves the addition of chromium as an internal standard and requires no other chemical pretreatment. The samples are spotted directly onto chromatographic paper disks and analyzed by X-ray fluorescence spectrometry. The method is rapid and is best for the quantitative determination of Fe in waters where the Fe content is in the range of from 5 to 400 p. p. m. -- F. T. Piskur

12374. Roberts, Franklin L., J. F. Wohnus, and Susumu Ohnu (City of Hope Med. Center, Duarte, California). 1970. PHOSPHOGLUCOMUTASE POLYMORPHISM IN THE RAINBOW TROUT, Salmo gairdneri. Chemical Abstracts, 72(5): 18614z; Commercial Fisheries Abstracts, 23(5): p. 24, 1970.

12375. Burnet, A. M. R. (Fisheries Lab., Marine Dept., Christchurch, New Zealand). 1969. THE GROWTH OF NEW ZEALAND FRESHWATER EELS IN THREE CANTERBURY STREAMS. N. Z. J. mar. Freshwat. Res., 3(3): 376-384.

The growth of both species of New Zealand freshwater eel, Anguilla australis and A. dieffenbachii, was studied by tagging in three streams using a stainless steel subcutaneous tag. Possible causes of the differences in growth rates are discussed. (Auth. summ.)

12376. Koops, H., H. Mann, I. Pfitzner, O. J. Schmid, G. Schubert. 1969. CAULIFLOWER DISEASE OF EELS. (Blumenkohlkrankheit bei Aalen). Archiv für Fischereiwissenschaft, 20(1): 1-52.

Cauliflower disease of eels is spreading in parts of Northern Europe. As yet the disease is absent in Western Europe, the Mediterranean region, America, and Japan. The threat to eel fisheries has caused concern due to their economic importance. The authors warn against its further spread. Koops and Mann describe the disease, its occurrence, distribution and significance. Schmid deals with histopathology and etiology. Ingrid Pfitzner documents the viral nature of the disease with excellent photomicrographs of cell and tissue culture investigations. G. Schubert gives support to the virus etiology of the disease in numerous electron microscope photographs showing the presence of polyhedral particles of 30 nm diameter which are assumed to be the cause of the disease. -- S. F. Snieszko

12377. Enomoto, Yoshimasa. 1969. SOME NOTES ON THE FLUCTUATIONS OF THE IMMATURE LEUCOCYTE NUMBER IN THE BLOOD OF CULTURED FISH. Bull. Tokai Fish. Res. Lab., Tokyo, No. 58, pp. 191-201. (In Japanese with English abstract).

Immature leucocytes were counted in "ayu", yellow-tail, eel, and rainbow trout. Rates of occurrence were 0-0.2% for most species; no changes were observed in connection with growth, maturation or water temperature. Immature leucocytes increased only when infectious diseases or inflammations were observed; thus, these may be the immature forms of granulocytes, which exhibited the same tendency of variation in occurrence. (From auth.)

12378. Stabrovskiĭ, E. M. (Lab. of the Evolution of Endocrine Functions of the Inst. of Evolutionary Physiology and Biochemistry named after I. M. Sechenova AN SSSR, Leningrad, USSR). 1968. ADRENALIN AND NORADRENALIN IN THE ORGANS OF THE CARP Cyprinus carpio NORMALLY AND WITH FUNCTIONAL STRESSES (Adrenalin i Noradrenalin v organakh karpa cyprinus carpio v norme i pri funktsional'nykh nagruzkakh). Journal of Evolutionary Biochemistry and Physiology (Zhurnal Évolyutsionnoĭ Biokhimii i Fiziologii), 4(4): 338-341. Translation from the Russian by Robert M. Howland.

The predominant catecholamine in the organs of the carp is noradrenalin. The greatest amount of noradrenalin and adrenalin is contained in the pronephros of the carp. Asphyxiation for 1 hour causes decrease in the amount of adrenalin in the pronephros and accumulation of it in the liver. After 2 hours of the effect of asphyxiation the adrenalin content also drops in the heart and spleen. The amount of noradrenalin with asphyxiation decreases in the pronephros, heart and liver. A fifteen-minute intensified motor activity of the carp is accompanied by decrease in the amount of noradrenalin and adrenalin in the pronephros and heart and increase of their content in the skeletal muscles. Rest for 1 hour replenishes the stores of noradrenalin in the pronephros. (Auth. conclusion)

12379. Gusev, G. P., V. F. Vasil'eva, Yu. V. Natochin, and E. I. Shakhmatova (Lab. of Evolution of the Excretory Function Inst. of Evolutionary Physiology and Biochemistry named after I. M. Sechenova AN SSSR, Leningrad, USSR). 1969. ION-REGULATING FUNCTION OF THE KIDNEY OF THE SKATE Raja clavata. (Ionoreguliruyushchaya Funktsiya Pochki Skata Raja clavata). Journal of Evolutionary Biochemistry and Physiology (Zhurnal Évolyutsionnoĭ Biokhimii i Fiziologii), 5(1): 30-37. Translation from the Russian by Robert M. Howland.

After intramuscular injection into skates of 10 percent solutions of Na, K, Ca or Mg salts, calculated on 5 milliequivalents per kg of weight, the excretion of these ions with the urine did not change during the 2-4 hours of the experiment. Introduction into a vein of such amounts of salts of these cations leads to increase of their concentrations in the blood serum and gradual increase of their concentration in the urine. The level of K and Ca secretion is almost unchanged in this; the secretion of Mg grows significantly. After the introduction of NaCl, its resorption is depressed and the secretion of K is lowered; the transport of these ions probably is specified by the activity of the K-Na-ion-exchange pump. During the two hours following intravenous injection, the increase of excretion of the introduced ions does not exceed several percentage points of the injected dose. The kidney of the skate probably does not play a significant role in an urgent homeostatic reaction, but provides only gradual correction of the ion composition of internal fluids. (Authors resume)

12380. Stabrovskiĭ, E. M. (Lab. of the Evolution of Endocrine Functions of the Inst. of Evolutionary Physiology and Biochemistry named after I. M. Sechenova, AS USSR, Leningrad, USSR). ADRENALIN AND NORADRENALIN IN THE ORGANS OF CARTILAGINOUS AND BONY FISHES OF THE BLACK SEA. (Adrenalin i noradrenalin v Organakh Khryashchevykh i Kostistykh Ryb Chernogo Morya). 1969. Journal of Evolutionary Biochemistry and Physiology (Zhurnal Évolyutsionnoĭ Biokhimii i Fiziologii). 5(1): 38-41. Translation from the Russian by Robert M. Howland.

The greatest amount of adrenalin and noradrenalin is contained in the kidneys. The amount of adrenalin and noradrenalin in the kidneys of fish is dependent on their living conditions. In fishes that migrate great distances the stores of catecholamines in the kidneys considerably exceed the content of amines in little-active fishes. Adrenalin dominates over noradrenalin in the body of the marine teleosts investigated. Noradrenalin is the predominant hormone in the cartilaginous fishes. (Auth. resume)

12381. Suzuki, Akimi. 1969. PRODUCTION OF HEMAGGLUTININS BY CARP. Bull. Tokai Fish. Res. Lab., Tokyo, No. 58, pp. 135-146. (In Japanese with English abstract).

Data are presented concerning the production of hemagglutinins in carp

immunized with the stroma of skipjack erythrocytes and the cells of carp. (From auth.)

12382. Enomoto, Yoshimasa. 1969. SOME NOTES ON THE FLUCTUATIONS OF THE IMMATURE ERYTHROCYTE NUMBER IN THE BLOOD OF CULTURED FISH. Bull. Tokai Fish. Res. Lab., Tokyo, No. 58, pp. 173-189. (In Japanese with English abstract).

Rates of occurrence of immature erythrocytes in the blood of "ayu", yellowtail, eel and rainbow trout are discussed in regard to growth, season, maturation and diseases. (From auth.)

12383. Tabata, Kenji. 1969. STUDIES ON THE TOXICITY OF HEAVY METALS TO AQUATIC ANIMALS AND THE FACTORS TO DECREASE THE TOXICITY - I. ON THE FORMATION AND THE TOXICITY OF PRECIPITATE OF HEAVY METALS. Bull. Tokai Fish. Res. Lab., Tokyo, No. 58, pp. 203-214. (In Japanese with English abstract).

Some experiments were done with regard to solubility of Zn^{2+} added to environmental water, the factors controlling it, and the toxicity of fine precipitates of heavy metals. If heavy metals precipitate in environmental water, they will not harm aquatic animals. However, Zn precipitate in sea water was toxic to Mytilus edulis. While metals were toxic in solution, the amount of OH^-, or CO_3^{2-} in the water affected the toxicity significantly. Dissolved Sn^{4+}, Cr^{3+}, Al^{3+}, and Fe^{3+} were not acutely toxic to aquatic animals within the pH range shown in water quality criteria. (From auth.)

12384. Tabata, Kenji. 1969. STUDIES ON THE TOXICITY OF HEAVY METALS TO AQUATIC ANIMALS AND THE FACTORS TO DECREASE THE TOXICITY - II. THE ANTAGONISTIC ACTION OF HARDNESS COMPONENTS IN WATER ON THE TOXICITY OF HEAVY METAL IONS. Bull. Tokai Fish. Res. Lab., Tokyo, No. 58, pp. 215-232. (In Japanese with English abstract).

The TL_m of metal ions increased almost 2.8 ± 0.6 fold when hardness in water increased 8 fold by addition of $CaCl_2$ and $MgSO_4$. This applies to Zn^{2+}, Cu^{2+}, Ni^{2+}, Co^{2+}, or Cd^{2+} as heavy metal ions, with Japanese killifish, carp, rainbow trout or daphnia as test animals and more than 24 hours test duration. The toxicity of Hg^{2+} or Mu^{2+} was not affected by hardness. The toxicity of heavy metal ions was affected slightly by sodium ions. (From auth.)

12385. Nishikawa, Katsuo, and Kenji Tabata. 1969. STUDIES ON THE TOXICITY OF HEAVY METALS TO AQUATIC ANIMALS AND THE FACTORS TO DECREASE THE TOXICITY - III. ON THE LOW TOXICITY OF SOME HEAVY METAL COMPLEXES TO AQUATIC ANIMALS. Bull. Tokai Fish. Res. Lab., Tokyo, No. 58, pp. 233-241. (In Japanese with English abstract).

The toxicity of heavy metal ions decreased considerably with the addition of sodium thiosulfate or sodium citrate, etc. With addition of EDTA the toxicity of such highly toxic heavy metals as Cu^{2+} or Hg^{2+} decreased remarkably, but the toxicity of lowly-toxic Ni^{2+} or Co^{2+} increased. It was considered that the toxicity might be attributable to EDTA. Carp grew well in a complex solution containing Cu^{2+} equivalent to 10-fold TL_m concentration and sodium thiosulfate. Thus, one should take complexing substances into account in certain instances when one discusses the toxicity of heavy metals in environmental water. (From authors)

12386. Suzuki, Taneko. 1969. BIOCHEMICAL STUDIES ON WINTERING OF CULTURE CARP - IV. SOME CHANGES IN MUSCLE PROTEINS OF CARP DURING WINTER. Bull. Tokai Fish. Res. Lab., Tokyo, No. 59, pp. 49-54. (In Japanese with English abstract).

Sarcoplasmic and salt soluble proteins decrease and the streaming birefrengence of salt soluble protein changes during the non-feeding period of wintering carp; however, the muscle proteins recover after wintering. (From auth.)

12387. Tabata, Kenji. 1969. STUDIES ON THE TOXICITY OF HEAVY METALS TO AQUATIC ANIMALS AND THE FACTORS TO DECREASE THE TOXICITY – IV. ON THE RELATION BETWEEN THE TOXICITY OF HEAVY METALS AND THE QUALITY OF ENVIRONMENTAL WATER. Bull. Tokai Fish. Res. Lab., No. 58, pp. 243-253. (In Japanese with English abstract).

The 24 hr. TL_m of Zn^{2+} to daphnia in water samples collected from 8 freshwater areas was determined. It was found that there is generally a relationship between the toxicity of heavy metals and water quality. The difference in the toxicity of heavy metal ions in various freshwater areas of the world was calculated on the basis of this relationship. The toxicity of heavy metal ions exhibited in the average quality of Japanese fresh water increased about 2.5 fold in comparison with that in North America. Fifty important rivers and lakes in Japan were classified into 6 groups according to hardness, and the difference in the toxicity of heavy metal ions among these groups was estimated. (From auth.)

12388. Tabata, Kenji, and Katsuo Nishikawa. 1969. STUDIES ON THE TOXICITY OF HEAVY METALS TO AQUATIC ANIMALS AND THE FACTORS TO DECREASE THE TOXICITY – V. A TRIAL TO DECREASE THE TOXICITY OF HEAVY METAL IONS BY THE ADDITION OF COMPLEXING AGENTS. Bull. Tokai Fish. Res. Lab., Tokyo, No. 58, pp. 255-264. (In Japanese with English abstract).

Investigation was made to determine whether the counteraction of complexing agents on the toxicity of heavy metal ions could be applied to decrease the toxicity of industrial wastes. The addition of sodium citrate or EDTA to copper mine waste, and sodium thiosulfate to mercury pesticide resulted in remarkable removal of toxicity. Cu-EDTA complex was more stable against bacterial decomposition than was Cu-citrate. Cu complexed with thiosulfate or citrate accumulated in the body of aquatic animals, while Cu complexed with EDTA accumulated only slightly. Such removal of toxicity might be suited to the secondary purification of industrial wastes in which a small quantity of toxic heavy metals remained after customary purification. A disadvantage of EDTA as a complexing agent is its high cost. The addition of EDTA to waste in which a small quantity of Cu^{2+} remained might be effective for the prevention of green oyster. (From authors)

12389. Takeuchi, Masaaki, Junya Shiose, Haruo Sasaki, Tokugoro Kaneko, and Masao Tominaga. 1969. BIOCHEMICAL STUDIES ON WINTERING OF CULTURE CARP – I. ON REARING-EXPERIMENTS DURING WINTER. Bull. Tokai Fish. Res. Lab., Tokyo, No. 59, pp. 1-17. (In Japanese with English abstract).

Experiments were conducted to investigate the problem of carp weight-loss and mortality during wintering at culture facilities. Mortality rates of carp which wintered without any artificial protection were 22.8% and 30.1%, and their weight decreases averaged 12.8% and 12.7%. A group of carp showing low mortality had been held in water with little temperature fluctuation. The condition coefficient and hepatopancreas weight index (ratio of hepatopancreas weight to body weight) of fish decreased during wintering. (From authors)

12390. Takeuchi, Masaaki, and Seiñosuke Ishii. 1969. BIOCHEMICAL STUDIES ON WINTERING OF CULTURE CARP – II. CHANGES OF THE OIL CONTENT, FATTY ACID COMPOSITION AND GLYCOGEN CONTENT IN THE MUSCLE AND HEPATOPANCREAS. Bull. Tokai Fish. Res. Lab., Tokyo, No. 59, pp. 19-27. (In Japanese with English abstract).

In regard to the oil content in muscle and hepatopancreas of carp, there was little difference between fish in December and April. Also, the fatty acid composition in these tissues did not change during winter; however, the glycogen content decreased sharply. (From authors)

12391. Lewis, A. G., J. Dean, and E. Gilfillan, III (Inst. of Oceanography, Univ. of British Columbia, Vancouver, Canada). 1969. TAXONOMY AND HOST ASSOCIATIONS OF SOME PARASITIC COPEPODS (CRUSTACEA) FROM PELAGIC TELEOST FISHES. Pacific Science, 23(4): 414-437.

12392. Tanaka, Takeo. 1969. BIOCHEMICAL STUDIES ON WINTERING OF CULTURE CARP - III. CHANGES IN MOISTURE CONTENT AND WATER HOLDING CAPACITY OF CARP MUSCLE. Bull. Tokai Fish. Res. Lab., Tokyo, No. 59, pp. 29-47. (In Japanese with English abstract).

Six-month-old carp were reared in groups under different conditions. Fish were removed at the start of wintering, at the middle of wintering, and at the end of wintering, and the muscle analyzed for moisture content, water holding capacity and drip loss changes during the wintering period. Moisture content increased during February and April, whereas the water holding capacity decreased, and the drip loss increased. Culturing suggestions are given based on the results. (From auth.)

12393. Fujii, Yutaka, and Akemi Suzuki. 1969. BIOCHEMICAL STUDIES ON WINTERING OF CULTURE CARP - V. VARIATIONS OF THE CONTENTS OF ATP-BREAKDOWNS IN THE MEAT AND THE SERUM PROTEIN. Bull. Tokai Fish. Res. Lab., Tokyo, No. 59, pp. 55-63. (In Japanese with English abstract).

The contents of ATP + ADP in meat and the protein values in serum, measured in nine groups of carp, decreased in midwinter. Contents of ATP + ADP and protein values measured in non-feeding groups were lower in comparison with those of feeding groups. It is indicated that the higher the environmental temperature rises during wintering, the more badly affected is the physiological condition of carp. (From authors)

12394. Shimizu, Yasuyuki, Toshio Onishi, and Shigeo Murayama. 1969. BIOCHEMICAL STUDIES ON WINTERING OF CULTURE CARP - VI. CHANGES OF VITAMIN B_2 CONTENT, AMYLASE ACTIVITY AND GPT (GLUTAMIC-PYRUVIC TRANSAMINASE) ACTIVITY IN HEPATOPANCREAS. Bull. Tokai Fish. Res. Lab., Tokyo, No. 59, pp. 65-73. (In Japanese with English abstract).

Changes of vitamin B_2 content, amylase activity and GPT activity were investigated in the hepatopancreas of wintering carp. Vitamin B_2 content and amylase activity decreased during winter, whereas GPT activity increased. Vitamin B_2 content and amylase activity reached the lowest, and GPT activity the highest, in April. Three groups reared under different conditions showed a definite difference in their GPT- and amylase activity. In April, the amylase activity of fish reared in spring water and the GPT activity of fish reared in running water were lower than in the other groups. Activities of amylase and GPT differed by sample groups, which seemed ascribable to food deficiency for the former, and physiological stress for the latter. (Authors)

12395. Uchiyama, Hitoshi, Shigeo Ehira, Masaaki Takeuchi, and Hiroshi Kobayashi. 1969. BIOCHEMICAL STUDIES ON WINTERING OF CULTURE CARP - VII. SEASONAL CHANGES IN NUCLEIC ACIDS LEVELS AND ACTIVITIES OF XANTHINE OXIDASE AND PROTEASE IN HEPATOPANCREAS OF CARP. Bull. Tokai Fish. Res. Lab., Tokyo, No. 59, pp. 75-80. (In Japanese with English abstract).

Research has been undertaken throughout a year on nucleic acid levels and activities of xanthine oxidase and protease in hepatopancreas of carp. RNA levels in the hepatopancreas of the carp increased from spring, attaining the maximum in summer, then continued to decrease towards winter. Presumably, this finding indicates a cyclic change in RNA level in a year. The change might be related to the temperature of water where the carp have been living, and the growth rate. However, the changes in DNA levels were found to be negligible. The xanthine oxidase activity of the hepatopancreas of the carp was found not to be correlated with the growth rate, showing the maximum in May. This is not in accord with the results of studies on the rat. The activity of protease was not in proportion to the growth rate of the carp. (Authors)

12396. Hile, Ralph (U. S. Bur. of Comm. Fisheries, Ann Arbor, Michigan). 1970. BODY-SCALE RELATION AND CALCULATION OF GROWTH IN FISHES. Trans. Amer. Fish. Soc., 99(3): 468-474.

Most calculations of fish growth from scale measurements are made from one of four types of curves: straight line through the origin (Dahl-Lea); straight line with intercept (Lee); logarithmic line (Monastyrsky); empirically derived curve (Segerstrale). Occasionally, different curves are used for different length intervals of fish. Present understanding of the basic principles of research on the body-scale relation is good but certain problems still await clear solution. Nomographic devices for the calculation of growth appeared early. Many of these unnecessarily had a moving part. The simplest nomograph yet developed and one that can be adapted to any kind of body-scale relation was described by Carlander and Smith. Computers appear to be destined to replace nomographs in most large-scale research on growth. (Auth.)

12397. Anderson, Robert D., and Charles F. Boyan (Calif. Coop. Fish. Unit, Humboldt State College, Arcata, California). 1970. AGE AND GROWTH OF THREE SURFPERCHES (EMBIOTOCIDAE) FROM HUMBOLDT BAY, CALIFORNIA. Trans. Amer. Fish. Soc., 99(3): 475-482.

Using the scale method, age and growth characteristics of 1481 surfperches comprising three species (Cymatogaster aggregata, Hyperprosopon argenteum, and Phanerodon furcatus) were studied. They were collected from North Humboldt Bay from September 1967 to December 1968. There were few differences in length-weight relationships among species and between sexes; those which emerged between sexes may have been due to the sampling schedule. The linear relationships between body length and scale radius in all three species yielded high correlation coefficients. The shiner perch grew considerably less than the walleye surfperch and white seaperch; the last two had similar growth histories. Females of each species were generally longer than males, but most of this advantage was gained by the end of the second year of life. (Authors)

12398. Lux, F. E., A. E. Peterson, Jr., and R. F. Hutton (U.S. Dept. of Interior, Bur. of Comm. Fisheries Biol. Lab., Woods Hole, Massachusetts). 1970. GEOGRAPHICAL VARIATION IN FIN RAY NUMBER IN WINTER FLOUNDER, Pseudopleuronectes americanus (Walbaum), OFF MASSACHUSETTS. Trans. Amer. Fish. Soc., 99(3): 483-488.

Numbers of dorsal and anal fin rays of 1,142 winter flounder in 18 samples from inshore waters off Massachusetts north and south of Cape Cod and from Georges Bank were compared as part of a study of subpopulations. Fish from south of Cape Cod had more fin rays than those from north of the Cape, and fish from Georges Bank had more fin rays than those from either inshore area. The relationship of water temperature to the number of fin rays was examined. (Authors)

12399. Lane, Charles E., and Robert J. Livingston (Inst. of Mar. and Atmosph. Sci., Univ. of Miami, Miami, Florida). 1970. SOME ACUTE AND CHRONIC EFFECTS OF DIELDRIN ON THE SAILFIN MOLLY, Poecilia latipinna. Trans. Amer. Fish. Soc., 99(3): 489-495.

A flowing water dilutor system is described that delivers known, consistent concentrations of pesticide in filtered sea water to six pairs of 90 liter aquaria. In this system sailfin mollies, Poecilia latipinna, were exposed to various concentrations of dieldrin in both acute and chronic experiments. More than half of the experimental fishes survived 0.0015 and 0.00075 ppm of pesticide for 34 weeks. However, 0.012 ppm dieldrin killed all exposed fishes within the first week. Fishes exposed to 0.0075 ppm of pesticide contained more than 1.0 ppm in gills and blood after only one hour. After 144 hours exposure, gills, blood, and brain each contained more than 6.0 ppm as determined by gas chromatography. Dieldrin concentrations in the gut, liver, and muscle after 144 hours ranged from 2.0 ppm to over 8 ppm. The mortality rate was accelerated after twenty-four hours when all sampled tissues contained between 5 and 11 ppm of dieldrin. (Authors)

12400. Hannon, Michael R., Yvonne A. Greichus, Richard L. Applegate and Alfred C. Fox (Exper. Station Biochem. Dept. and Coop. Fish. Unit, South Dakota State Univ., Brookings, South Dakota). 1970. ECOLOGICAL DISTRIBUTION OF PESTICIDES IN LAKE POINSETT, SOUTH DAKOTA. Trans. Amer. Fish. Soc., 99(3): 496-500.

Ecological distributions of chlorinated hydrocarbon residues in Lake Poinsett, South Dakota, were studied from June, 1967 to June, 1968. DDT and its metabolites, DDD and DDE, were the highest residues detected in all trophic levels examined. Heptachlor, heptachlor epoxide, aldrin, dieldrin and lindane were present in the majority of sample types, while neither endrin nor methoxychlor was detected above analytical confidence limits in any sample. Toxaphene was present in four fish. Water had the lowest total residue reported. Bottom sediments and crayfish had 18 times the residue level of water, while zooplankton and benthic algae showed a 37-fold increase over water. Total residue in fish averaged 790 times that of water and aquatic insects had the highest increase over water (7300-fold). Residue levels in Lake Poinsett water were similar to levels reported for other areas, but fish displayed a much lower magnification over water than has been reported in the literature. (From authors)

12401. Adelman, Ira R., and Lloyd L. Smith, Jr. (Dept. of Entomol., Fish. and Wildlife, Univ. of Minnesota, St. Paul, Minnesota). 1970. EFFECT OF HYDROGEN SULFIDE ON NORTHERN PIKE EGGS AND SAC FRY. Trans. Amer. Fish. Soc., 99(3): 501-509.

A series of bioassays were conducted to test the effect of H_2S at two concentrations of oxygen on northern pike (Esox lucius L.) eggs and sac fry. At an oxygen concentration of approximately 2 ppm mean median tolerance limits (TL_m) for eggs were 0.411, 0.076, 0.038, 0.034, and 0.030 ppm H_2S for 24, 48, 72, 96 hours, and for the duration of the embryonic period, respectively. At an oxygen concentration of approximately 6 ppm mean median tolerance limits (TL_m) were 0.181, 0.046, 0.041, 0.037, and 0.032 ppm H_2S for 24, 48, 72, 96 hours, and for the duration of the embryonic period, respectively. Mean TL_m values for sac fry were 0.035, 0.016, 0.012, and 0.009 ppm H_2S at 2 ppm oxygen and 0.160, 0.047, 0.030, and 0.026 ppm H_2S at 6 ppm oxygen for 24, 48, 72, and 96 hours, respectively. Eggs subjected to H_2S resulted in increasing percentages of sac fry with anatomical malformations. Sac fry hatched from eggs held at the higher H_2S concentrations were smaller than the controls. Sac fry subjected to H_2S showed decreased growth rates at the higher concentrations. The maximum possible safe level of H_2S for eggs is between 0.014 and 0.018 ppm and for sac fry between 0.004 and 0.006 ppm for 96 hours exposure. (Authors)

12402. Marking, Leif L. (Bur. of Sport Fish. and Wildl., Fish Control Lab., LaCrosse, Wisconsin). 1970. JUGLONE (5-HYDROXY-1, 4-NAPHTHOQUINONE) AS A FISH TOXICANT. Trans. Amer. Fish. Soc., 99(3): 510-514.

Juglone, a biologically active chemical occurring in various parts of walnut trees, was tested for its toxicity to fish. The 96-hour LC50 values obtained from static bioassays at 12C range from 27 to 88 parts per billion for rainbow trout, northern pike, goldfish, carp, white suckers, black bullheads, channel catfish, green sunfish and bluegills. The toxicity of juglone to rainbow trout and bluegills was not altered significantly in waters of different temperature or hardness. Standard (pH = 7.4) and buffered (pH = 9.0) solutions of juglone aged for one week effectively killed rainbow trout although approximately three times as much juglone was required at the higher pH. According to other investigators, juglone is easily reduced to less toxic components by factors in the natural environment. However, juglone is sufficiently persistent to eliminate target fish prior to its degradation. (Auth.)

12403. Takatalo, S., S. Kolehmainen, and J. K. Miettinen (Dept. of Radiochem., Univ. of Helsinki, Helsinki, Finland). 1970. EXCRETION OF IODINE BY PERCH (Perca fluviatilis). Trans. Amer. Fish. Soc., 99(3): 515-517.

The biological half-time of iodine in perch (Perca fluviatilis) was determined

at 13 and 25C using iodine-131 and whole body counting. Iodine excretion followed a two-exponential function. At 13C the fast component showed a half-time of 1.5 days, the slow one 9 days. At 25C the half times were 15 hrs and 5 days, respectively. It is assumed that the fast component mainly represents plasma clearance, the slow one clearance from the thyroid organs. (Authors)

12404. Gregory, Richard W. (Res. Center, Colorado Game, Fish and Parks Div., Fort Collins, Colorado). 1970. PHYSICAL AND CHEMICAL PROPERTIES OF WALLEYE SPERM AND SEMINAL PLASMA. Trans. Amer. Fish. Soc., 99(3): 518-525.

Semen was collected from 33 sexually mature walleye, Stizostedion vitreum vitreum (Mitchell), captured in 3 northeastern Colorado reservoirs. Physical and chemical measurements were made on each sample of semen. The physical properties measured and the mean values of each were: total length (of fish), 555.3 mm; weight (of fish), 1,694.6 g; spermatocrit (percentage of packed cells to total volume), 55%; freezing point depression ($\Delta°$) – 0.489; dry weight as % of wet weight, 20.8%, and ash weight as % of dry weight, 11.33%. Chemical analyses were run on individual samples of seminal plasma to determine pre- and post-freezing levels of certain constituents and to measure changes which occur following freezing. The values obtained in mg/100 ml were: Ca, 3.2 to 1.5; Cl,467.5 to 427.9; Mg, 1.6 to 4.7; P, 5.3 to 51.9; K, 97.0 to 156.8; Na, 383.3 to 241.6; total protein, 2.6 to 5.9; urea N, 2.9 to 8.1; and uric acid 3.3 to 11.1, respectively for pre- and post-freezing levels. These properties were also measured in frozen and thawed sperm cell cytoplasm. Simple linear regression analysis was conducted on all variables measured. Chemical properties of fresh walleye seminal plasma are compared to values obtained by other authors for Atlantic salmon (Salmo salar), human, bull, fowl and dog seminal plasma. (Auth.)

12405. Edsall, Thomas A., and Peter J. Colby (U. S. Bur. of Comm. Fish., Great Lakes Fish. Lab., Ann Arbor, Michigan). 1970. TEMPERATURE TOLERANCE OF YOUNG-OF-THE-YEAR CISCO, Coregonus artedii. Trans. Amer. Fish. Soc., 99(3): 526-531.

Young-of-the-year ciscoes (Coregonus artedii) acclimated to 2, 5, 10, 20, and 25C and tested for tolerance to high and low temperatures provide the first detailed description of the thermal tolerance of coregonids in North America. The upper ultimate lethal temperature of the young ciscoes was 26C (6C higher than the maximum sustained temperature tolerated by adult ciscoes in nature) and the ultimate lower lethal temperature approached 0C (near that commonly tolerated in nature by adult ciscoes). The temperature of 26C is slightly higher than the lowest ultimate upper lethal temperature recorded for North American freshwater fishes; however, published information on the depth distributions of fishes in the Great Lakes suggests that some of the other coregonids may be less tolerant of high temperatures than the cisco. (Authors)

12406. VanDerwalker, John G. (U. S. Bur. of Comm. Fish., Seattle, Washington). 1970. RESPONSES OF FINGERLING COHO AND CHINOOK SALMON TO MODIFIED FLOWS IN A SIMULATED TURBINE INTAKE. Trans. Amer. Fish. Soc., 99(3): 532-539.

Experiments were conducted to determine if the percentage of fingerling coho (Oncorhynchus kisutch) and chinook (O. tshawytscha) salmon that entered the gatewell of a simulated turbine intake could be increased by modifying the configuration of its ceiling. Two configurations tested substantially increased the number of fish entering the simulated gatewell. (Auth.)

12407. Bender, Michael E., and Robert A. Jordan (Dept. of Environ. Health, School of Public Health, Univ. of Michigan, Ann Arbor, Michigan). 1970. PLASTIC ENCLOSURE VERSUS OPEN LAKE PRODUCTIVITY MEASUREMENTS. Trans. Amer. Fish. Soc., 99(3): 607-610.

Data are presented which indicate that polyethylene columns suspended in a body of water cannot be expected to function as miniature lakes for nutrient addition experimentation.

12408. Brown, B. D., I. Inman, and A. Jearld, Jr. (Oklahoma Coop. Fish. Unit, Stillwater, Oklahoma). 1970. SCHOOLING AND SHELTER SEEKING TENDENCIES IN FINGERLING CHANNEL CATFISH. Trans. Amer. Fish. Soc., 99(3): 540-545.

Schooling and shelter seeking tendencies in fingerling channel catfish were investigated from 1966 to 1968 by observing fish stocked in plastic pools. The catfish formed aggregations near the bottom of the pools during daylight hours when shelters were absent. On disturbance, flight schools were formed. When shelters were present the fish took shelter during the day; the schools tended to enter the shelter as a whole rather than breaking up. At night, fish were out of the shelters, were dispersed, and did not form flight schools when disturbed. When temperatures were below 4C the fish remained in shelters and aggregations both day and night. Fish with barbels removed did not deviate from the behavior described above. Blinded fish associated with each other and with normal fish in resting aggregations but could not keep up with flight schools. Fish kept in constant darkness remained dispersed. (Authors)

12409. Bowman, Milton L. (Dept. of Zoology, Univ. of Missouri, Columbia, Missouri). 1970. LIFE HISTORY OF THE BLACK REDHORSE, Moxostoma duquesni (Lesueur), IN MISSOURI. Trans. Amer. Fish. Soc., 99(3): 546-559.

The abundance of the black redhorse (Moxostoma duquesni) within Missouri rivers appeared to be correlated with volume of flow: the greatest biomass occurred in streams with an annual average discharge of 500-600 cfs. The breeding behavior of the adult black redhorse is described. There was no parental care of the eggs. The body-scale relationship for the populations of each river was best represented by a combination of two straight lines. It is suggested that the break in the body-scale relationship was related to the attainment of sexual maturity. Black redhorse from the Big Piney River grew in length and gained in weight slightly faster than the black redhorse from the Niangua River. This difference in growth is attributed to a difference in intensity of harvest. Similarities existed between food items of black redhorse and fingerling smallmouth bass which may have been due to the smallmouth bass utilizing drift organisms from sucker feeding activities. Seasonal and daily movements of the black redhorse were most extensive in spring and fall with little or no movement during summer and winter periods. On the basis of movement and spawning data, it is postulated that the black redhorse within a particular river constitute a rather homogeneous population. (Auth.)

12410. Swedberg, Donald V., and Charles H. Walburg (No. Central Reservoir Investigations, Yankton, South Dakota). 1970. SPAWNING AND EARLY LIFE HISTORY OF THE FRESHWATER DRUM IN LEWIS AND CLARK LAKE, MISSOURI RIVER. Trans. Amer. Fish. Soc., 99(3): 560-570.

The early life history of freshwater drum, Aplodinotus grunniens, was studied in 1965-67 to determine factors influencing year-class strength in a main stem Missouri River reservoir. Fish spawning occurred over a period of 6-7 weeks in June and July when water temperatures reached 18C. Fecundity of fish 307 to 386 mm long and 6-9 years old ranged from 34,000 to 66,500 ova. Ova reared in the laboratory at a water temperature of 23C hatched in 27 hr and the prolarvae averaged 3.2 mm long. The prolarval stage was complete 45 hr after hatching and postlarvae averaged 4.4 mm long. Adult characters developed at an approximate length of 15 mm. Diet of fish 6-15 mm long was Daphnia and Cyclops. Bottom fauna became important in the diet of fish longer than 20 mm. Fish movement between channel and floodplain was related to changes in diet. Growth, year-class strength, and mortality varied among years. Strong year classes were associated with warm summer (June-August) water temperatures in the spawning and nursery area and weak year classes with cold temperatures. Size of year class was determined before fish attained a length of 25 mm. (Authors)

12411. Lind, Owen T., and Robert S. Campbell (Dept. of Zoology, Univ. of Missouri, Columbia, Missouri). 1970. COMMUNITY METABOLISM IN ACID AND ALKALINE STRIP-MINE LAKES. Trans. Amer. Fish. Soc., 99(3): 577-582.

Community metabolism was measured over a 24-month period by a modified diel oxygen procedure in three Missouri strip-mine lakes, one acid and two formerly acid. Water pH ranged from 3.2 to 8.1. Biotic diversity was inversely related to acidity. Maximum daily values of gross photosynthesis were similar in the lakes (7.9, 7.6 and 6.5 g O_2 m^{-2} day^{-1}). The highest rates of annual gross volumetric photosynthesis (586 and 682 g O_2 m^{-3} yr^{-1}) were found in the more nearly eutrophic alkaline lake in both 1963-64 and 1964-65. Annual areal gross photosynthetic values were variable among the lakes in 1963-64, but similar in 1964-65. Community respiration values, which were reasonably similar in the lakes, were considerably lower than in ponds and Texas coastal bays of similar photic depth. Rates of community respiration closely paralleled gross photosynthesis so that the P/R ratio of each lake fluctuated about unity. Community function in these acid and alkaline strip-mine lakes, judged by rates of photosynthesis and respiration, compares favorably with community function in non-acid natural waters. (Authors)

12412. Baker, Claude D., William H. Neill, Jr., and Kirk Strawn (Dept. of Zoology, Univ. of Arkansas, Fayetteville, Arkansas). 1970. SEXUAL DIFFERENCE IN HEAT RESISTANCE OF THE OZARK MINNOW, Dionda nubila (Forbes). Trans. Amer. Fish. Soc., 99(3): 588-591.

Brighter colored males of the Ozark minnow (Dionda nubila) were generally the first of a particular sample to perish in lethal heat baths. Drab males seemed to be little less resistant than females. Stream temperature fluctuations may be an important regulating factor in the breeding ecology of the Ozark minnow.

12413. Peck, James W. (Mich. Dept. of Natural Resources, Marquette, Michigan). 1970. STRAYING AND REPRODUCTION OF COHO SALMON, Oncorhynchus kisutch, PLANTED IN A LAKE SUPERIOR TRIBUTARY. Trans. Amer. Fish. Soc., 99(3): 591-595.

The continued introduction of non-imprinted salmon will most surely result in widespread straying and reproduction. Imprinting could significantly reduce straying and concentrate the mature fish for optimum angling and commercial harvest.

12414. Hale, John G., and Donald A. Hilden (Fed. Water Quality Admn., Nat. Water Quality Lab., Duluth, Minnesota). 1970. THE INFLUENCE OF FLOW ON THE SPAWNING OF BROOK TROUT IN THE LABORATORY. Trans. Amer. Fish. Soc., 99(3): 595-597.

Brook trout spawning took place in tanks with a constant flow, as well as in tanks with periodic flow. The rate of flow did not appear to influence spawning success, since it was accomplished at 1/2, 1, and 2 liters a minute.

12415. Williams, Wells E. (Dept. of Nat. Science, Michigan State Univ., East Lansing, Michigan). 1970. SUMMER FOOD OF JUVENILE BLACK BULLHEADS (Ictalurus m. melas) OF MITCHELL LAKE, WEXFORD COUNTY, MICHIGAN. Trans. Amer. Fish. Soc., 99(3): 597-599.

Of the total volume of food consumed by juvenile black bullheads (10-60 mm), 90% was entomostraca (ostracods and copepods), 9% was insects and 1% was other food items. Insects eaten were largely tendipedid larvae. They accounted for 5.6% and Trichoptera 0.3% of the total food volume.

12416. Watson, Jay F. (Univ. of Mass., Coop. Fish. Unit, Dept. of Forestry and Wildl., Amherst, Massachusetts). 1970. MARKING JUVENILE AMERICAN SHAD BY IMMERSION IN BISMARCK BROWN Y AND NEUTRAL RED. Trans. Amer. Fish. Soc., 99(3): 600-602.

Immersion in neutral red does not appear to be a suitable marking technique for juvenile American shad. Mortality at all concentrations tested was high and the mark retention at lower concentrations was brief. Bismarck brown Y, from these

tests, appears to be a suitable stain for marking juveniles. At a concentration of 1:30,000 for 40 minutes the mark was retained for three days and the mortality was low (5%).

12417. Mathur, G. B., and B. D. Shrivastava (School of Studies in Zoology, Vikran Univ., Ujjain, India). 1970. AN IMPROVED ACTIVITY METER FOR THE DETERMINATION OF STANDARD METABOLISM IN FISH. Trans. Amer. Fish. Soc., 99(3): 602-603.

To measure the standard metabolic rate it is desirable to make simultaneous measurements of oxygen consumption and activity. In an investigation of the standard respiration of the cyprinoid, Rasbora daniconius (Ham. Buch.), we used a modification of the heat loss apparatus used by Beamish and Mookherjii (1964). The advantages of this modified meter are that it does not require any special glassblowing and that the magnetic head provides a convenient and accurately reproducible setting.

12418. Hudson, Patrick L. (U. S. Bur. of Sport Fish. and Wildl., No. Central Reservoir Investigations, Yankton, South Dakota). 1970. QUANTITATIVE SAMPLING WITH THREE BENTHIC DREDGES. Trans. Amer. Fish. Soc., 99(3): 603-607.

The sampling characteristics of the 9" x 9" Ekman, the Ponar and a No. 1 orange-peel were tested in the laboratory and in the field. The Ekman dredge is restricted in use to soft lake bottoms. The Ponar dredge is the most versatile of the three samplers tested and is only limited in deposits of silt over 12.7 cm. The orange-peel dredge, with its variable sampling characteristics and production of a shock wave, is of questionable value.

12419. Winnicki, Aleksander, and Ryszard Bartel. 1968. NATURAL AND ARTIFICIAL EGG DEFORMATIONS IN THE SALMONID FISHES. Zoologica Poloniae, 18(3): 417-426.

The study includes observation of brown trout eggs developing in natural and artificial conditions, as well as measurements of their lateral diameters. It has been found that due to the plasticity of its membranes, immediately after fertilization, the spherical shape of the egg may be changed considerably by the mechanical factors in the surroundings. As a result, its two lateral diameters differ in length much more than has been established earlier for eggs developing in hatching apparatuses. Still greater deformations were obtained with eggs, which had been flattened during their swelling and hardening of their membranes. The shape the fish egg takes at an early stage of development is maintained without any significant changes until the end of development. The paper discusses the biological importance of these phenomena. Egg-membrane plasticity followed by elasticity have been reported from many other species of bony fishes (Coregonus albula L., Esox lucius L., Clupea harengus L.). (Authors summ.)

12420. Winnicki, Aleksander, Ryszard Bartel, and Krzysztof Goryczko. 1968. THE EFFECT OF TEMPERATURE ON THE UPTAKE OF WATER BY THE EGG AND ON THE HARDENING OF THE EGG MEMBRANES IN THE RAINBOW TROUT, Salmo gairdneri Rich. Zoologica Poloniae, 18(4): 431-442.

Immediately after dry-spawning, the eggs were placed in crystallizing dishes containing water at 1, 8 and 15°C. Measurements of the specific weight, turgor, and of the egg-membrane strength were made at intervals of several minutes. It was found that the water intake, turgor, and egg-membrane strength clearly depend on water temperature. Temperature does not affect the ultimate value of water uptake, or of the egg-membrane strength, but it influences the dynamics of these processes immediately after the egg is placed in the water. (Authors)

12421. Dawson, C. E. (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1966. A BIBLIOGRAPHY OF ANOMALIES OF FISHES - SUPPLEMENT 1. Gulf Research Reports, 2(2): 169-176.

12422. Winnicki, Aleksander, Ryszard Bartel, and Krzysztof Goryczko. 1968. SOME DATA CONCERNING THE MECHANISM RESTRICTING THE VOLUME OF THE PERIVITELLINE SPACE IN SALMONID FISHES. Zoologica Poloniae, 18(1): 27-36.

The authors interrupted artificially the intake of water by the eggs of Salmo trutta (L.) and Salmo gairdneri (Rich) before the eggs became completely swollen, and caused an acceleration of hardening of the egg-coverings. They investigated whether the eggs would be able to continue the absorption of water.

12423. Ghittino, P. (Inst. Zooprofilattico Sperimentale del Piemonte e Liguria, Italy). 1970. RESPONSE OF HATCHERY TROUT TO DIETHYLSTILBESTROL AND METHYLTHIOURACILE. (Risposta delle trote d'allevamento al dietilstilbestrolo e metiltiuracile). Riv. It. Piscic. Ittiopat., 5(1): 9-11.

The General Directorate of Veterinary Services of Italy granted the present study. The aim of the research was to determine if reared trout may be treated with diethylstilbestrol (STB) and methylthiouracile (MTU) to obtain a growth effect. Thirteen different commercial trout feeds and 8 reared-trout samples (official sampling) proved to be completely free from such additives. STB and MTU were mixed at a rate of 5 g and 500 g/100 Kg of pellets, respectively. This was fed daily at 1 percent of body weight, and the trout thus received 50 mg and 5 g/100 Kg of body weight of the two chemicals. The growth of trout fed STB and MTU was lower than control-trout growth. Such compounds slightly depressed the growth instead of enhancing it. The same negative effect was present, even if less evident, in trout fingerlings kept in water at 15-16°C. The conversion of pellets containing STB was 2.47:1, MTU 2.53:1, and of control pellets 1.97:1. Gross and microscopic examinations of experimental trout were negative for significant changes. However, an intense hyperplasia of the thyroid gland occurred in trout fed MTU. (Auth. summ.)

12424. Jorgensen, P. E. Vestergaard. 1970. THE SURVIVAL OF VIRAL HEMORRHAGIC SEPTICEMIA (VHS) VIRUS ASSOCIATED WITH TROUT EGGS. Riv. It. Piscic. Ittiopat., 5(1): 13-14.

During spring 1969 one liter of green eggs fertilized immediately before transportation were obtained at a trout farm where VHS is observed every winter, but where no symptoms of the disease were present at the time of spawning. A sample of the eggs was taken immediately after the arrival at the laboratory for virological examination. After that, the eggs were separated into two groups, one of which was infected with 50 ml of cell culture derived Egtved virus (strain F-1 pas 86) containing $10^{7.3}$ $TCID_{50}$ per ml, whereas the other one, serving as a control, received 50 ml of cell culture medium. After gentle stirring for two minutes, the eggs were transferred to hatching cylinders and water circulation was started at a rate of one liter per minute. The water temperature was about 10°C. Samples of eggs and later of fry for virological examination were taken after 15 minutes, 60 minutes, 3.5 hours, 48 hours and then approximately twice a week until six weeks after the start of the experiment, at which time fry had been present for two weeks. A final sample of fry was taken after four months. The first sample of eggs taken immediately after the arrival at the laboratory contained Egtved virus and consequently the whole batch of eggs was considered to be naturally infected. This actually was the first time that Egtved virus has been isolated from eggs. In the naturally infected eggs Egtved virus was isolated until 3.5 hours after the start of water circulation but not later. In the group of eggs which were also experimentally infected, Egtved virus was isolated until the 10th day but not later. None of the samples of fry could be shown to contain Egtved virus. These results seem to indicate that Egtved virus in naturally infected eggs may be present only on the surface of the eggs, and that adhering virus may be removed by the water stream or eliminated in other ways before susceptible fry are present.

12425. Ghittino, P. (Inst. Zooprofilattico Sperimentale del Piemonte e Liguria, Torino, Italy). 1970. DIETETIC REQUIREMENTS OF THE EEL. (Fabbisogni dietetici dell'anguilla). Riv. It. Piscic. Ittiopat., 5(1): 19-20.

In Japan, knowledge of the dietetic requirements of cultured eels is well developed. In that country, many private companies are delivering eel dry-feeds (self-sustaining). The eel is a champion indeed in transforming artificial diets into good proteins for human consumption. It can eat up to 15 percent and more of its body weight. Studies are now being undertaken to establish the vitamin requirements of such fish by following the method used by American scientists for salmonids. The synthetic diet of HALVER proved useful in this research. (Auth. summ.)

12426. Ghittino, P. (Inst. Zooprofilattico Sperimentale del Piemonte e Liguria, Torino, Italy). 1970. PARASITOSIS DUE TO Apiosoma (Glossatella) cylindriformis IN REARED ELVERS (Anguilla anguilla). Riv. It. Piscic. Ittiopat., 5(1): 21-22.

The author briefly describes a skin and gill parasitosis, due to the protozoan Apiosoma (Glossatella) cylindriformis, occurring in elvers (Anguilla anguilla) caught in the Mediterranean and reared experimentally. Such fry (6-6.5 cm, 0.12-0.19 g) were kept in a concrete tank in which brackish water was recirculated and electrically heated. Parasitized fish gradually refused to feed. The disease was controlled by transferring fish into pure water or by formalin (1:4,000/1 hr) or malachite green baths (0.15 mg/litre, extended period). (Auth. summ.)

12427. Tanaka, Minoru. 1969. ON THE RELATIONS BETWEEN MATURATION AND BODY SIZE IN POND-REARED KOKANEE SALMON (Oncorhynchus nerka). Bull. Freshw. Fish. Res. Lab., Tokyo, 19(1): 1-7. (In Japanese with English synopsis)

In order to take eggs from pond-reared Kokanee salmon (Oncorhynchus nerka) and conduct planned egg distribution, fundamental knowledge is needed in relation to maturity and body size. Experimental fish of one to three years old were divided into eight groups and reared in different ponds. Growth rate, development of the gonads, and the number and size of mature or immature fish were measured monthly from May, 1967 to May, 1968. The ovary began to develop slowly at first during May to June, but it grew rapidly after August and attained full maturity in September. The growth rate of the testis was almost the same as that of the ovary at the initial stage; however, it attained full maturity in August and decreased gradually thereafter. Judging from the egg diameter or gonad index in May, the fish could be classified into ones maturing and not maturing within the year. More than half the females would be mature within the year if they had grown to more than 20.5 cm in May. In the males, smaller fish (16 - 18 cm) were ascertained to mature. Females numbered more than males in two groups of three year fish. In the groups of one and two year fish, however, the smaller the body size the more females there were. In other words, males predominated in the larger size groups. The degree of maturation was far advanced in larger females. The male matured earlier, in general, than the female. Furthermore, the number of matured males was much more than that of females during the season.

12428. Suzuki, Ryo. 1969. NOTES ON THE EDEMATOUS FRY IN FISH HYBRIDS. Bull. Freshw. Fish. Res. Lab., Tokyo, 19(1): 17-21.

Hybrid embryos were artificially produced between distinct families, subfamilies and genera in Cyprinidae and Cobitidae. Most of the embryos from interfamilial and intersubfamilial crosses developed into edematous fry and all of them never lived beyond the larval stage. From observation of cross sections of edematous hybrid fry, it was found that their pronephroi were collapsed or non-existent. In some hybrids, hypertrophy was detected in the anterior portion of the pronephric duct where the posterior was collapsed or not present. (Auth. summ.)

12429. Sevcik, B., Kral, J., J. Danek, M. Kubic'ova, V. Soukup, B. Ungermann, and F. Jupa. 1968. THE DEVELOPMENT OF AN ANTIBIOTIC PREPARATION FOR PREVENTION AND THERAPY OF SEPTICAEMIA HAEMORRHAGICA IN CARPS. (Vyvoj peroralniho antibiotickeho pripravku k prevenci a terapii infekcni vodnatelnosti kapru). Veterinaria SPOFA, 10(2): 175-188.

In the Research center for Veterinary Medicaments Spofa a peroral antibiotic preparation against septicaemia haemorrhagica of carps is being developed in cooperation with the national establishment Farmakon. In the first phase of development, described in the preliminary communication, a granular preparation of 3-5 mm radius was used containing besides the nutritive element an active component of chloramphenicol -- palmitate (1.25 mg per 1 g of preparation), stabilized vitamins A and D_3, obduction substances and a corrigent for taste. This preparation showed sufficient resistance against leaching of chloramphenicol in an aqueous environment. The amount of leached chloramphenicol averaged 6.08% after 6 hours, and 9.20% after 12 hours, of the total content of chloramphenicol. In two model experiments, the chloramphenicol level in the blood serum of carp after a one-time peroral application of the preparation was followed. In the first experiment, 20 g of the preparation was applied per 1 kg of live weight. Average amounts of chloramphenicol found in 1 ml of serum were 0.82 γ; 0.50 γ; 0.28 γ after 6, 30 and 50 hours, respectively. Elevation of the level was influenced by water temperature decrease in the natural environment. In the second experiment, fish were held under laboratory conditions at a constant water temperature of 18°C. The application comprised 14 g of the preparation per 1 kg of live weight. Twelve hours after application, the chloramphenicol level in the blood serum of the fish reached, on the average, 1.02 γ/ml, after 36 hours 0.74 γ/ml and 0.26 γ/ml after 72 hours. The preparation was also tested under field conditions in a pond with a natural source of infection. After appearance of the first symptoms of septicaemia haemorrhagica, the preparation was administered 2-3 times a week over the course of 1 month with a total dose of 160 g per carp of 600-700 g weight. From the beginning of application (May 22nd) to removal of the fish (September 20th) no loss was recorded. In removed carp, 6 hours after their spontaneous acceptance of food, the level of chloramphenicol in the blood serum was 0.58 γ/ml, after 12 hours it was 0.41 γ/ml and after 24 hours it was 0.26 γ/ml. In another experiment, an increased quantity of the preparation was administered to carp placed in an artificially infected environment for 40 days. No septicaemia hemorrhagica in the experimental carp was recorded during the period. (From authors)

12430. Allen, K. Radway (Fish. Res. Bd. of Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1969. LIMITATIONS ON PRODUCTION IN SALMONID POPULATIONS IN STREAMS. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 3-18.

Production, however defined, usually includes both a numerical component, determined by reproduction, immigration, mortality and emigration, and a weight component primarily determined by growth. Thus all environmental features affecting any of these processes can potentially limit production. All stream-living salmonids begin life as eggs buried in the stream bed and numerical production, up to the time of emergence, and potential production by weight thereafter, are limited by factors which determine either the number of eggs successfully deposited and/or survival during incubation. These include extent of spawning areas, volume of stream discharge and permeability of gravel. In the species which descend to the sea immediately after emergence, the only other factor significantly limiting production is probably predation, particularly by other species of fish, during the descent. In the species which remain for some time in streams, predation may also limit the number of survivors and hence the amount of production, although, in terms of weight, its effects may be offset by compensating increases in growth rate. Most salmonids which remain in streams are strongly territorial and this provides a mechanism limiting production since it determines, through the size of the territories, the maximum numerical density which even suitable stream beds can support. The relation for area of stream bed per fish corresponds

to an average density of about 1.7 g/sq m (15 lb/acre) and, in many streams studied by biologists, tends to be about 1/15th of the density found in the actual territories. The other component of production, growth, is controlled primarily by the amount of food eaten. The bottom fauna is generally the principal source of food of stream-living salmonids and, by its density, can limit production. Climatic factors, particularly temperature, may also exert direct influence on the rate of growth and hence on production. (From auth.)

12431. Smith, S. B. (Fish & Wildl. Div., Alberta Dept. of Land and Forests, Edmonton, Alberta, Canada). 1969. REPRODUCTIVE ISOLATION IN SUMMER AND WINTER RACES OF STEELHEAD TROUT. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 21-38.

Steelhead in a sexually immature state, entering streams largely between June and September are designated as "summer" fish and those entering in a sexually mature state, are designated as "winter" fish. Progeny from summer and from winter fish from Capilano River, British Columbia were reared together, in order to determine the extent to which taxonomic and physiological characteristics are heritable. Some taxonomic characteristics are heritable to the extent that meristic series, such as numbers of vertebrae, gill rakers and parr-marks in F_1 yearling fish can be used to separate summer and winter stocks, but not individuals of the two stocks. Artificial fertilizations, including reciprocal crosses, indicated that summer and winter stocks are mutually viable. However, detailed examination of migratory behaviour and taxonomic and physiological characters in Capilano River steelhead strongly indicate that the two races do not interbreed in that stream; samples from wild populations from six other rivers provided data consistent with the same hypothesis. (From auth.)

12432. McCart, P. (Fish. Res. Bd. Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1969. DIGGING BEHAVIOUR OF Oncorhynchus nerka SPAWNING IN STREAMS AT BABINE LAKE, BRITISH COLUMBIA. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 39-51.

Female Oncorhynchus nerka, sockeye and kokanee spawning in streams prepare a nest in the gravel by repeated digging. After the spawning act, the eggs deposited in the nest are covered by repeated digging at its edges. Pre- and post-spawning digging differ in a number of ways: in the frequency of digging, the number of flexures per dig, the direction in which the female turns, the orientation of the female to the current and the decreased tendency to alternate sides while digging. Except that kokanee have a higher rate of flexure, the digging of female sockeye and kokanee is similar. Male sockeye and kokanee also dig. Male digging is less vigorous than that of females and is not always closely oriented to the nest. Situations in which male digging commonly occurs are described. It is suggested that male digging is a displacement activity. (Auth.)

12433. Hartman, G. F. (British Columbia Fish and Wildlife Branch, Canada). 1969. REPRODUCTIVE BIOLOGY OF THE GERRARD STOCK RAINBOW TROUT. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 53-67.

Kootenay Lake contains a race of large rainbow trout which are considered to be distinct from other rainbow trout in the lake. Most of these fish spawn in a short section of the Lardeau River at the outlet of Trout Lake. In this restricted area of the river, gravel and water velocities are quite homogeneous. Water temperatures are stable during and after the spawning period. Spawning behavior is briefly described. Spawning activities in this region include much aggression among male fish and some among females. Nest digging is continuous around the clock during the peak of spawning. Speculation is offered about the role of aggression and space competition in such a restricted area in maintaining or leading to large size in individuals in the race. (Auth.)

12434. Barns, R. A. (Biol. Sta., Nanaimo, British Columbia, Canada). 1969. ADAPTATIONS OF SOCKEYE SALMON ASSOCIATED WITH INCUBATION IN STREAM GRAVELS. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 71-87.

Successful development in and escape from the intergravel environment poses specific problems to salmonid larvae. Adaptive responses have developed to cope with these problems. They include behavioural responses, such as ventilation swimming, coughing, negative phototaxis and directed emergence, as well as physiological responses, such as early hatching, branchial respiration, gill cleaning by mucous secretion, and "spontaneous" initiation of emergence behaviour. Some implications associated with development in the gravel and optimal time of lake entry illustrate the extent, complexity, appropriateness and sensitivity of adaptation required to fit the animal for its way of life. (Auth.)

12435. Dill, Lawrence M. (Dept. of Fisheries of Canada, Vancouver, British Columbia, Canada). 1969. THE SUB-GRAVEL BEHAVIOUR OF PACIFIC SALMON LARVAE. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 89-99.

Results of a study of the sub-gravel behaviour of the coho salmon (Oncorhynchus kisutch) are compared with studies of other salmonid larvae. The present results were obtained through observation of the larvae or alevins in specially designed aquaria. The alevins moved about within the gravel prior to emergence, apparently as a result of phototaxes and rheotaxes, the directions of which varied with the age of the fish. For example, the response to light was initially negative, but changed to positive as the time of emergence approached. Lateral movements were similarly influenced by the current direction. There was evidence that the alevins were spacing themselves out within the gravel, and that some interaction was taking place between them. The effects upon behaviour of changes in burial density, burial depth, and gravel size were also explored. Several studies are suggested as logical and productive continuations of the present work, and their implications are discussed from both practical and theoretical standpoints. (Auth.)

12436. McNeil, William J. (Oregon State Univ., Dept. of Fisheries & Wildl., Corvallis, Oregon). 1969. SURVIVAL OF PINK AND CHUM SALMON EGGS AND ALEVINS. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 101-117.

The production of pink (Oncorhynchus gorbuscha) and chum (O. keta) salmon fry is controlled by density-dependent mortality. Production from Sashin Creek, Little Port Walter, southeastern Alaska, approaches a maximum of about 500 fry per m^2 of spawning ground at an egg deposition of 2,000 to 3,000 eggs per m^2. The production curve for Sashin Creek is dome shaped. Mortality from droughts, floods, or freezing temperatures may exceed 50 percent of the eggs and alevins in spawning gravels, but such mortality appears, for the most part, to be independent of population size. Superimposition of redds, on the other hand, causes density-dependent mortality; studies at Sashin Creek indicate that survival of eggs and alevins is higher when spawning is early than when it is late. Thus, a dome-shaped production curve in freshwater may result from replacement of more viable eggs from early spawners by less viable eggs from late spawners as the total number of spawners increases beyond the level where superimposition of redds becomes a frequent occurrence. (Auth.)

12437. Waters, Thomas F. (Dept. of Entomology, Fisheries & Wildl., Univ. of Minnesota, St. Paul, Minnesota). 1969. INVERTEBRATE DRIFT-ECOLOGY AND SIGNIFICANCE TO STREAM FISHES. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 121-134.

Many species of invertebrates, though not all, exhibit high rates of downstream drift in a diel periodicity. Most are night-active, for whom light intensity is the

phase-setting mechanism; but some species are day-active, for whom water temperature may be the phase-setter. Diel patterns consist of one or more peaks, occurring at various times of the 24-hour period depending on species. Magnitude of the drift appears to be a function of water temperature, current velocity, stage of life cycle, and population density and growth rate. The direct significance of invertebrate drift to stream fish is in an apparent increase in availability as food. Whereas stream salmonids utilize drifting invertebrates as food to varying degrees, a substantial proportion of the diet is also gained by bottom foraging. (Auth.)

12438. Mundie, J. H. (Fish. Res. Bd. Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1969. ECOLOGICAL IMPLICATIONS OF THE DIET OF JUVENILE COHO IN STREAMS. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 135-152.

The requirements of the salmonid egg result in fry emerging into turbulent unproductive water. There is, therefore, a precarious balance between energy spent by fry obtaining food and the reward gained. Coho fry save energy by living close to the margin of streams. This results in loss of mid-stream foods. The holding capacity of streams may be raised by the artificial provision of marginal back eddies. The earliest meals of fry reflect the habitat on emergence and the size of the fish; later foods can be very diverse. Their analysis can be facilitated by collecting drift and emerging insects simultaneously. The correspondence between drift and diet in a 24-hr period need not be close. Where food is scarce exuviae are eaten, where plentiful, they are rejected. The food sources of the insects which make up the diet are the primary production of lakes, detritus of terrestrial origin, or its microflora, and terrestrial production. An ideal food channel would receive contributions from each of these, and have shallow fast-flowing water, narrow width, numerous areas of marginal slack water and no extremes of flow. Increased production of coho is most likely to come from measures of flow regulation ranging from simple stream management to elaborate engineering projects. (Auth.)

12439. Chapman, D. W., and T. C. Bjornn (Idaho Coop. Fish. Unit, Moscow, Idaho). 1969. DISTRIBUTION OF SALMONIDS IN STREAMS, WITH SPECIAL REFERENCE TO FOOD AND FEEDING. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 153-176.

Autecology of fish distributions is treated with particular attention to behavior of young chinook salmon and steelhead trout in Idaho streams. Behaviour of other fish species and races is examined and discussed. In the warmer months young chinook salmon and steelhead trout are associated with velocities and depths in proportion to body size, shifting to faster and deeper waters as body growth occurs. Interaction for space between species is minimal because of differing times of fry emergence. Distribution close to high-velocity water is food-related and density is socially-controlled with the greatest distributional role of social behavior played among fish of near-equal size. During the day the fish remain in a small home area, then settle at night to the bottom, generally after moving inshore. Beginning in September many young steelhead and chinook salmon move downstream from tributaries to overwinter in larger streams, often living in the stream substrate. Most fish disappear into the substrate at temperatures below about 5C, and winter cover is important in holding over-wintering fish. Distributional behavior of young salmon and steelhead in the warmer months is similar to that of several other salmonid species. Winter hiding behaviour is common in stream salmonids, often preceded by downstream movement in the fall. Return upstream movements in spring often occur. Such behavior in the colder months is probably directly related to water temperature. (Authors)

12440. Northcote, T. G. (Brit. Columbia Fish & Wildl. Branch and Inst. of Fish., Univ. of British Columbia, Vancouver, Canada). 1969. PATTERNS AND MECHANISMS IN THE LAKEWARD MIGRATORY BEHAVIOUR OF JUVENILE TROUT. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 183-203.

Patterns of migratory behaviour of juvenile rainbow trout are examined for populations where lake dwelling adults spawn in (a) simple inlet stream systems, (b) outlet streams, (c) both inlet and outlet streams, and (d) complex tributary systems. Contrasting evidence for lack of movement is presented for "isolated" populations living in headwater streams above waterfalls. Possible mechanisms inducing different migratory patterns are discussed and speculations given on their evolutionary significance in trout and other salmonids. (Auth.)

12441. Mills, Derek H. (Dept. of Forestry and Natural Resources, Univ. of Edinburgh, Scotland). 1969. THE SURVIVAL OF JUVENILE ATLANTIC SALMON AND BROWN TROUT IN SOME SCOTTISH STREAMS. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 217-228.

While survival is mainly density-dependent, climate, stream characteristics and interspecific inter-relationships also affect survival. These factors are discussed in relation to production estimates and stream management procedures. (Auth.)

12442. Latta, W. C. (Inst. for Fish. Res., Michigan Dept. of Natural Resources, Ann Arbor, Michigan). 1969. SOME FACTORS AFFECTING SURVIVAL OF YOUNG-OF-THE-YEAR BROOK TROUT, Salvelinus fontinalis (Mitchill), IN STREAMS. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 229-240.

Survival of brook trout during the first year of life was considered in relation to territorial behavior, other segments of the trout population, starvation and amount of groundwater entering the stream. Predation by older brook trout does not account for losses sustained by newly emerged fry. Starved brook trout are relatively long-lived. Death rate of trout fry from starvation increases in a curvilinear way with a rise in water temperature. Starvation lowers the resistance of young fish to biological and physical stresses of the environment. Groundwater levels in the lower reaches of trout streams (but not in the headwaters) are directly correlated with numbers of young-of-the-year brook trout present. Speculations were made on the role of food in the survival of young brook trout. (Auth.)

12443. Kawanabe, Hiroya (Dept. of Zoology, Kyoto Univ., Kyoto, Japan). 1969. THE SIGNIFICANCE OF SOCIAL STRUCTURE IN PRODUCTION OF THE "AYU", Plecoglossus altivelis. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 243-251.

The "Ayu", a salmon-like fish, is one of the most dominant fishes in the rivers of Japan, grazing on diatoms and blue-green algae growing on stones. The Ayu is an annual fish as well as being amphidromous. Eggs are laid in late autumn and the young mature, spawn and die the following autumn. Spawning occurs in rivers, and young descend to the ocean shortly after hatching, live along the coast during winter, and ascend rivers in the spring where they grow and mature as adults. They show various types of social behaviour during the season when territories are established. The territory normally occupied by an individual Ayu is about 1 m^2 when the overall population density in the river is lower than 3 individuals /m^2. The growth of territorial fish at low population density is good and most attain more than 40 gm wet weight by late summer. Non-territorial fish at the same low density have poor growth, generally less than 50 gm by late summer. Mortality of Ayu in rivers is not greatly affected by food supply (algal production) or population density, but their production is greatly influenced by their own social structure. (From auth.)

12444. Fraser, F. J. (Canada Dept. of Fisheries, Canada). 1969. POPULATION DENSITY EFFECTS ON SURVIVAL AND GROWTH OF JUVENILE COHO SALMON AND STEELHEAD TROUT IN EXPERIMENTAL STREAM-CHANNELS. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 253-265.

In nature, coho salmon and steelhead trout are closely associated in their first year of life. This association, combined with initial high densities, must play an important role in determining growth and survival. This study was designed to measure density effects upon the population dynamics of these fry. Three hypotheses were tested: (1) that growth rates are density-dependent, (2) that survival rate is largely species-specific and, (3) that interspecific competition will be less intense than intraspecific competition. Steelhead fry have a faster initial growth rate than coho, enabling them to exceed the coho in growth despite the latter's earlier hatching and consequent initial size advantage. Growth rates were inversely related to density, both inter- and intraspecific effects being noticeable. Survival data indicated that this aspect of their population dynamics was largely species-specific. The effects of competition, both inter- and intraspecific, were found to be greatest within the high-density group, where minimal biomass was produced. The effects were much less within the intermediate groups where competition was almost entirely intraspecific. The low-density groups experienced minimal competition. (Auth.)

12445. LeCren, E. D. (Freshwater Biol. Assn., The River Lab., East Stoke, Wareham, Dorset, England). 1969. ESTIMATES OF FISH POPULATIONS AND PRODUCTION IN SMALL STREAMS IN ENGLAND. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 269-280.

Approximate estimates of total annual fish production have been made for ten small streams in England. The production of Salmo trutta ranged from 2 to $12 g/m^2/a$ and was very similar to $10-12 g/m^2/a$ in five of the streams though these were very different in their general ecology and trout populations. The more productive 'chalk streams' had a total fish production of up to $60 g/m^2/a$; most of it due to Cottus gobio. Production of three different species of salmonids in some American streams is similar to that of trout in English streams, but S. trutta in the Horokiwi River and in experimental streams can have a production of up to $50 g/m^2/a$. (Auth.)

12446. McFadden, James T. (Dept. of Wildlife and Fisheries, School of Natural Resources, Univ. of Michigan, Ann Arbor, Michigan). 1969. DYNAMICS AND REGULATION OF SALMONID POPULATIONS IN STREAMS. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 313-329.

Limited environmental resources, high population density, restricted movement, and territoriality favor development of intense competition among salmonids in streams. This competition is effective in diverse ways during the different parts of the life history. The effects of different life history patterns on the dynamics of populations are discussed. Evidence for both inter- and intra-cohort competition in a resident trout population is presented. Population regulation is described as a highly flexible process, not dependent on any single environmental factor. A substantial gap in knowledge exists between available field data which constitute numerical evidence of population regulation and the combined field and laboratory data which suggest possible mechanisms in some detail. This gap presents a formidable obstacle in attempting to synthesize models of salmonid populations useful in management programs. (Auth.)

12447. Idler, D. R., and B. Truscott (Fish. Res. Bd. Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1969. PRODUCTION OF 1α-HYDROXYCORTICOSTERONE IN VIVO AND IN VITRO BY ELASMOBRANCHS. Gen. and Comp. Endocrinology Supplement 2, pp. 325-330; Studies, Fish. Res. Bd. Canada, Part 2, No. 1325, pp. 37-42, 1970.

12448. Hall, James D., and Richard L. Lantz (Dept. of Fisheries and Wildlife, Oregon State Univ., Corvallis, Oregon). 1969. EFFECTS OF LOGGING ON THE HABITAT OF COHO SALMON AND CUTTHROAT TROUT IN COASTAL STREAMS. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of British Columbia, Vancouver, Canada, Feb. 1968, pp. 355-375.

The effects of two patterns of Douglas-fir logging on water quality and fish populations have been studied in three coastal headwater streams. Clearcut logging of an entire watershed of 71 hectares (175 acres) is being compared to clearcutting in patches on a larger watershed of 304 hectares (750 acres), where about 30 percent of the area has been harvested and a strip of timber left along the stream. The third watershed of 203 hectares (500 acres) will remain unlogged as a control. Pre-logging studies began in 1958, access roads were constructed in 1965, and logging took place in 1966. Substantial changes in temperature and dissolved oxygen content of stream water followed logging in the entirely clearcut watershed. A maximum temperature of 30°C and a maximum diurnal fluctuation of 16°C were recorded. Comparable pre-logging maximums were 16° and 1.5°, respectively. Dissolved oxygen levels of surface and intragravel water dropped below 2 mg/l during logging operations. Survival of coho salmon and cutthroat trout in the clearcut watershed has been affected by logging, but the significance of the effect cannot yet be fully evaluated. No significant changes in the fish population or its habitat have been noted in the patch-cut watershed. Studies will continue for several years to evaluate long-term effects of logging on the stream and to determine the period of recovery. (Authors)

12449. Calaprice, J. R. (Fisheries Res. Bd. Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1969. PRODUCTION AND GENETIC FACTORS IN MANAGED SALMONID POPULATIONS. H. R. MacMillan Lectures in Fisheries, Symp. on Salmon and Trout in Streams, Univ. of Brit. Columbia, Vancouver, Canada, Feb. 1968, pp. 377-388.

Fisheries management methods include transplanting organisms, applying restrictions on the catch, and supplementing natural reproduction by various means. The relative successes or failures of most of these measures have been attributed to method, or to specific interactions among organisms in the ecosystem. In the following, attention is focused upon the probable pattern of genetic variation in salmonids, some means whereby current management practices may modify these patterns, and the related heritable aspect of production. (Auth.)

12450. Whitfield, M. (CSIRO Div. of Fisheries and Oceanography, Cronulla, NSW 2230, Australia). 1969. Eh AS AN OPERATIONAL PARAMETER IN ESTUARINE STUDIES. Limnology and Oceanography, 14(4): 547-558; Commercial Fisheries Abstracts, 23(6): p. 1, 1970.

Inert metal electrodes (usually platinum), along with reference electrodes to form a complete cell, are widely used to measure the oxidation-reduction potential of chemical systems. By adding the appropriate value for the reference electrode potential corrected for liquid junction effects, one can obtain the redox potential Eh from the potential of the cell E. Problems associated with the technique of measurement, the performance of the inert metal electrode, and the thermodynamic behavior of the environment make quantitative interpretation of Eh measurements in the natural aqueous environment difficult. Nevertheless, the parameter is useful as a semiquantitative indicator of the degree of stagnation of a particular environment. The author describes a compound probe that reduces the technical problems associated with Eh measurements and makes possible the simultaneous measurement of pH, Eh, and pS^{2-} on a single sample. With the probe, Eh contours can be used to locate and map areas of stagnation even in a complex estuary. The technique can be used for planning detailed studies of the distribution of benthic fauna or of the effect of sediment-water interaction on the chemistry of the estuary. Values of Eh, corrected with pH and pS^{2-} measurements, can be used to determine information about the chemistry of the sediment. With the compound probe described here, says the author, all these properties can be recorded from a single sample after only a few hours' work. -- L. Baldwin

12451. Pacha, R. E., and E. D. Kiehn (Dept. of Microbiology, Oregon State Univ., Corvallis, Oregon). 1969. CHARACTERIZATION AND RELATEDNESS OF MARINE VIBRIOS PATHOGENIC TO FISH: (1) PHYSIOLOGY, SEROLOGY, AND EPIDEMIOLOGY (2) DEOXYRIOBONUCLEIC ACID HOMOLOGY AND BASE COMPOSITION. J. Bact., 100(3): 1242-1247 (1); pp. 1248-1255-(2); Commercial Fisheries Abstracts, 23(6): p. 3, 1970.

The purpose of the present study was to examine the characteristics of various marine vibrios pathogenic to fish and to compare these organisms with Vibrio anguillarum, a known fish pathogen. The first paper describes the cultural characteristics and serological relation of the pathogenic marine vibrios isolated from fish in the Pacific Northwest. Thirteen strains of Vibrio and vibriolike organisms were isolated. The Pacific Northwest strains of Vibrio were closely related to V. anguillarum. Three serotypes were distinguished by serological analyses of thermostable antigens. Serotype 1 consisted of organisms isolated from salmonids; serotype 2, of strains of V. anguillarum from European waters; and serotype 3, of organisms isolated from Pacific herring. The second paper reports on studies of base composition and nucleotide sequence relations of deoxyribonucleic acid (DNA) isolated from several pathogenic (to fish) marine vibrios. The experiments demonstrated the usefulness of DNA duplex formation and base composition studies in the classification and determination of relatedness of bacteria. Patterns of relatedness inferred from DNA criteria were found to correlate closely with those inferred from morphological, physiological, and serological analysis of the same organism. Furthermore, the results emphasized the strong compatibility of approaches based on genotypic and phenotypic characteristics. -- F. T. Piskur

12452. Shenderyuk, V. I., and O. N. Shumarova (Kaliningradskii Tekhnologisheskii Inst. Rybnoi Promyshlennosti i Khozyaistva, USSR). 1969. (PROTEINASES OF THE INTERNAL ORGANS OF ATLANTIC FISH). Izvestiya Vysshikh Uchebnykh Zavedenii, Pishchevaya Tekhnologiya No. 2, 25-26; Food Science and Technology Abstracts 1, No. 12, 1608, Item 12R316; Commercial Fisheries Abstracts, 23(6): p. 4, 1970.

The authors investigated (1) the qualitative composition of proteinases of the internal organs of various species of Atlantic fish, and compared their activity and (2) the proteolysis of the organs at various pH's in buffer solutions. Trypsin and pepsin were identified in the organs. The optimum pH for proteolysis differed with the fish being investigated. Proteolysis was fastest in mackerel and slowest in herring, due to the varying enzymatic activity of the two fish at natural pH. -- L. Baldwin

12453. Kato, Teiichi, and Yoshio Sakamoto. 1969. STUDIES ON THE VARIATION OF GROWTH IN RAINBOW TROUT, Salmo gairdneri - I. THE EFFECT OF GRADING OF BODY SIZE ON THE COURSE OF GROWTH. Bull. Freshw. Fish. Res. Lab., Tokyo, 19(1): 9-16.

The growth rate, variation of growth, survival rate and group maturity rate of the rainbow trout, Salmo gairdneri, were examined using 0-year and 1-year age. Fish were graded into three size groups (large, medium and small), and reared for eleven or nine months under a feeding schedule. Among the three groups, the average growth rate was the highest in the large size group and the lowest in the small size group. The growth rate decreased gradually in proportion to growth of the fish. The rate of increase of dispersion in body length of the 0-year class was higher than that of the 1-year class. Among the three groups, the rate of increase of dispersion was the lowest in the large size group. As for distribution of body length, the mode of the large and medium size groups drew toward the large side from the average in proportion to fish growth. The same tendency was found in the control. In the small size group, however, the mode drew toward the small side from the average. There were no differences among the three groups in rate of survival except the small size group in the 1-year class. Among the three groups, the group maturity rate was highest in the large size group and lowest in the small size group. (Authors synopsis)

12454. Inui, Yasuo. 1969. MECHANISM OF THE INCREASE OF PLASMA GLUTAMIC OXALACETIC TRANSAMINASE AND PLASMA GLUTAMIC PYRUVIC TRANSAMINASE ACTIVITIES IN ACUTE HEPATITIS OF THE EEL. Bull. Freshw. Fish. Res. Lab., Tokyo, 19(1): 25-30.

Three experiments were conducted to determine the mechanism of increase of P-GOT and P-GPT activities in hepatitis of the eel intoxicated by carbon tetrachloride. Among the various organs examined, the liver showed the highest activities of both P-GOT and P-GPT in pond cultured eels. GOT activities in other tissues decreased in the following order: heart, kidney, spleen, muscle, blood corpuscle and plasma; and GPT activity in the order: kidney, spleen, heart, muscle, blood corpuscle and plasma. Neither P-GOT nor P-GPT activity increased in the hepatectomized fish intoxicated by carbon tetrachloride. On the contrary, marked increase was observed in both P-GOT and P-GPT activities in the sham operated eel. The decrease of liver GOT and liver GPT activities in the CCl_4 poisoned eel coincided well with the increase of P-GOT and P-GPT activities. It may be concluded that the increase of both P-GOT and P-GPT activities in the CCl_4 intoxicated eel were the result of the release of liver GOT and liver GPT, respectively. (Auth. summ.)

12455. Nose, Takeshi. 1969. A PRELIMINARY REPORT ON SOME ESSENTIAL AMINO ACIDS FOR THE GROWTH OF EEL, Anguilla japonica. Bull. Freshw. Fish. Res. Lab., Tokyo, 19(1): 31-36.

The dispensability of some amino acids for the eel, Anguilla japonica, was examined by using an amino acid test diet. The fish which were fed diets deficient in dispensable amino acid grew as well as those fed the complete amino acid diet. The fish fed diets deficient in essential amino acid failed to grow until the missing amino acid was added to the ration. The appearance of very fast-growing fish verified the dispensability of the amino acid deleted from the complete test diet. For the six amino acids examined, valine, methionine, tryptophan and threonine were found to be indispensable, and proline to be dispensable. The dispensability of glycine was not verified. (Auth. summ.)

12456. Shimma, Yaichiro, and Hisako Shimma. 1969. A COMPARATIVE STUDY ON FATTY ACID COMPOSITIONS OF THE NATIVE AND REARED SILVER CARPS, BIG HEADS, AND GRASS CARPS. Bull. Freshw. Fish. Res. Lab., Tokyo, 19(1): 37-46, in Japanese with English synopsis.

Lipids were extracted from several tissues of native silver carp, Hypophthalmichthys molitrix, reared big heads, Aristichthys nobilis, and native and reared grass carp, Ctenopharyngodon idellus. Their fatty acid composition was analyzed by gas chromatography. The dorsal flesh contained 0.5-1.8% lipids in all fishes, and 87-108 mg% cholesterol in the big head, while 39-75 mg% of cholesterol in the others. The fatty acid composition of the dorsal flesh of the natives was almost the same, having 16:0, 16:1, 18:0, 18:1, 20:4, 20:5, and 22:6 acids as major components. The deposit lipids of the ventral flesh and abdominal and skull cavities of the grass carp showed different fatty acid composition than in the silver carp, having a higher content of 18:2 and 18:3 acids. In particular, oil in the skull cavities of three samples showed more than 20% of 18:3 acid. In analysis of the lipids of six samples of water plants, 18:2 and 18:3 acids were found in large amounts in their leaves. It is inferable that the high content of these acids in grass carp deposit lipids might come from their feed plants. A slight difference in fatty acid composition was observed between the native silver carp and the reared big head. Lipids of the reared grass carp were distinctly affected by the feed. In samples fed with marine fish (Decapterus lajang), 22:6 acid was found, 24.3-32.6% in the dorsal flesh, hepatopancreas and milt, while in the lipids of those given a commercial feed 22:6 acid amounted to 10.4-13.3% in the dorsal flesh and hepatopancreas, 7.2-8.6% in the milt and 14.6% in the eggs. The quality and quantity of the feed oil for parent fish seem to have an important role as regards the artificial offspring. (Authors synopsis)

12457. Forrester, C. R. (Fish. Res. Bd. Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1967. RESULTS OF ENGLISH SOLE TAGGING IN BRITISH COLUMBIA WATERS. Pacific Marine Fish. Comm. Bull., No. 7, 10 p.; Studies Fish. Res. Bd. Can., Part 2, No. 1319, pp. 1-9, 1970.

Between 1944 and 1961, approximately 25,000 English sole were tagged and released in British Columbia waters. Most of the tagging took place in the Strait of Georgia and northern Hecate Strait, the principal trawling areas for English sole. Approximately 6,500 recaptures (with usable information on locality) have been reported. Of these only 1.1% indicated movement to waters off the United States coast (exclusive of recoveries in the Strait of Georgia). Taggings conducted near the international boundary yielded the highest returns from United States waters, but none of these taggings was in localities supporting significant Canadian fisheries. Most of the recaptures off the open coast of the United States were in the region between Cape Flattery and Destruction Island, Washington, where spawning is known to occur in winter months. Tagging results, supported by results of meristic studies and the geographical distribution of catch, suggest there are two major stocks of English sole in British Columbia waters: one in Hecate Strait and the other in the Strait of Georgia. Within the latter area, there appear to be three sub-stocks or populations. Minor populations occur in other regions of the coast, such as Queen Charlotte Sound and various coastal inlets. In light of available information on water circulation, there is support in the tagging results for the hypothesis that the English sole engages in contranatant (upstream) migrations to various spawning areas. (Auth. summ.)

12458. Butler, D. G., W. C. Clarke, E. M. Donaldson, and R. W. Langford (Ramsay Wright Zool. Labs., Univ. of Toronto, Toronto, Canada). 1969. SURGICAL ADRENALECTOMY OF A TELEOST FISH (Anguilla rostrata LeSueur): EFFECT ON PLASMA CORTISOL AND TISSUE ELECTROLYTE AND CARBOHYDRATE CONCENTRATIONS. General and Comparative Endocrinology No. 12, pp. 503-514; Studies, Fish. Res. Bd. Can., Part 2, No. 1337, p. 169, 1970.

12459. Yamazaki, Fumio, and Edward M. Donaldson (Fish. Res. Bd. Can., Vancouver Lab., Vancouver, Brit. Columbia, Canada). 1969. INVOLVEMENT OF GONADOTROPIN AND STEROID HORMONES IN THE SPERMIATION OF THE GOLDFISH (Carassius auratus). General and Comparative Endocrinology No. 12, pp. 491-497; Studies, Fish. Res. Bd. Can., Part 2, No. 1336, pp. 161-167, 1970.

3β-hydroxysteroid dehydrogenase activity has been located in the interstitial cells of the goldfish testis. This activity falls rapidly after hypophysectomy reaching a very low or undetectable level within 25 postoperative days. Replacement therapy using salmon gonadotropin showed that this enzymic activity and spermiation are dependent on pituitary gonadotropin. However, the enzymic activity did not increase significantly at spermiation and spermiation could be induced even when there is a very low or undetectable level of 3β-ol dehydrogenase. A single injection of salmon gonadotropin induces spermiation and hypertrophy of the interstitial cells. Androgen was also found to be effective for the induction of spermiation. These facts suggest that despite the lack of a direct correlation between 3β-ol dehydrogenase and spermiation, the pituitary gonadotropin may act on the interstitial cells and induce the secretion of androgens which in turn bring about spermiation. (Authors)

12460. Fagerlund, U. H. M., and J. R. McBride (Fish. Res. Bd. Can., Vancouver Lab., Vancouver, Brit. Columbia, Canada). 1969. SUPPRESSION BY DEXAMETHASONE OF INTERRENAL ACTIVITY IN ADULT SOCKEYE SALMON (Oncorhynchus nerka). General and Comparative Endocrinology No. 12, pp. 651-657; Studies, Fish. Res. Bd. Can., Part 2, No. 1340, pp. 175-181, 1970.

Dexamethasone injected intraperitoneally as a single dose of 1 mg/kg of body weight suppressed cortisol secretion in response to stress in sexually maturing sockeye salmon. The full effect of a single dose was still evident after 5 and 6 days in most fish and in many fish after 12 days. Sexually maturing sockeye salmon which had received either four doses of dexamethasone during a period of

47 days or six doses during 75 days, were compared with controls which had received similar regimens of peanut oil. The progressive increase in interrenal hypertrophy during the treatment period seen in the peanut oil controls was abolished in the fish receiving dexamethasone. (Authors)

12461. Roberts, R. J., J. Leckie, and H. D. Slack (Univ. of Glasgow, Glasgow, Scotland). 1970. 'BALD SPOT' DISEASE IN POWAN Coregonus lavaretus (L.). J. Fish Biol., 2(2): 103-105.

The stocks of powan Coregonus lavaretus (L.) in Loch Lomond (Scotland) were affected by an acute non-ulcerative inflammatory lesion in the centre of the head, at the same time as ulcerative dermal necrosis (U. D. N.) became apparent in salmon in the Loch. The numbers of powan were very great at the time, and fish were of poor quality and frequently fungus-infected. No pathogen was isolated from the lesions which rarely contained fungus, and were histologically very different from the lesions of U. D. N. in salmon. Its disappearance by the following year, coincided with a marked improvement in quality of the fish. (Authors)

12462. Willoughby, L. G. (Freshwater Biol. Assoc., Ambleside, Westmorland, England). 1970. MYCOLOGICAL ASPECTS OF A DISEASE OF YOUNG PERCH IN WINDERMERE. J. Fish Biol., 2(2): 113-116.

A disease of young perch in Windermere was investigated. In contrast to the case of U. D. N. infections of salmon and trout, a variety of fungi were obtained from the diseased fish. These reflected the spora present in the water at the same time to a large extent. An exception was Saprolegnia ferax, which did not grow on the fish and indicated that some degree of host specificity was involved. The Achyla isolates, both from the fish and from the water, were found to be heterothallic and male in reaction. (Auth.)

12463. Egglishaw, Henry J. (Freshwater Fisheries Lab., Pitlochry, Perthshire, Scotland). 1970. PRODUCTION OF SALMON AND TROUT IN A STREAM IN SCOTLAND. J. Fish Biol., 2(2): 117-136.

For three years the population size, rates of growth, standing stock, production and yield of all year classes of salmon and trout within three sections of a stream in Scotland were studied. Total salmon production as fresh weight per m^2 was 6.5 g in 1966, 10.6 g in 1967 and 11.1 g in 1968, and total trout production was 10.3 g in 1966, 12.3 g in 1967 and 7.7 g in 1968. Fish of 0+ and 1+ year old provided usually more than 90% of the total annual salmon production and 80% of the annual trout production. Yield of salmon smolts (about 9 cm or longer after 2 years growth) per m^2 was 0.10 in 1966, 0.22 in 1967 and 0.15 in 1968. The smolt yield by weight was 29% of the production of the 1966 year class of salmon and 16% of the 1967 year class. Numbers of trout of 9 cm or longer produced in the same time were higher and their weight was 60% of the total production of the 1966 year class and 32% of the 1967 year class. (Auth.)

12464. Bagenal, T. B. (The Ferry House, Ambleside, Westmorland, England). 1970. NOTES ON THE BIOLOGY OF THE SCHELLY Coregonus lavaretus (L.) IN HAWESWATER AND ULLSWATER. J. Fish Biol., 2(2): 137-154.

Some aspects of the biology of the schelly Coregonus lavaretus (L.) were investigated by examining 188 that had passed down an aqueduct from Haweswater and 437 that were caught in gill nets set in Ullswater. In both lakes the main breeding season is from mid January to mid February, and in Ullswater spawning takes place in shallow water [less than 7.6 m (25 feet)] on a sandy bottom with stones and weed, at the entrance to a bay. The males in Haweswater first spawn when 3 years old and in Ullswater when 2; and the females first spawn in Haweswater when 4 years old, and in Ullswater when 3. Scales were kept from every fish and were found suitable for age determination. Some Haweswater schelly live for 9 years, but from Ullswater the oldest was 8. The rate of growth of male Haweswater schelly was very well described by the equation: $l_t = 41.046 (1-0.741^{t-0.375})$ (where l_t = the length of time at t) but the curve had to be transposed a further year to describe adequately the Ullswater male schelly growth. It is clear that the rates of growth are similar in the two lakes after the first

year, during which it is much faster in Ullswater. A study of the length-weight relation showed that the weight is proportional to the length cubed, and no difference in condition was found between males and females. The schelly egg was found to be slightly sticky, spherical and 2.98 mm in diameter. Some fertilized eggs were kept at various constant temperatures. At 4°C and 6°C the death rate was low, but was higher at 8°C and total mortality occurred at 10°C. This low upper lethal temperature probably restricts the spawning season to mid-winter and also limits the species' geographical range, as has also been suggested for the char Salvelinus alpinus (L.) whose eggs have similar temperature requirements. Some eggs were reared to adults, and these provided corroboration of the validity of the scales for age determination. Two other points mentioned in this paper were the occasional winter strandings of schelly, and the incidence of a supernumerary pelvic fin. (Auth.)

12465. Benkema, J. J. (Organization for the Improvement of Inland Fisheries, Utrecht, and Zool. Lab., Univ. of Groningen, The Netherlands). 1970. ACQUIRED HOOK-AVOIDANCE IN THE PIKE Esox lucius L. FISHED WITH ARTIFICIAL AND NATURAL BAITS. J. Fish Biol., 2(2): 155-160.

Tagged pike Esox lucius L. in a drainable pond were fished by hook and line, using either a spinner or a small live fish as bait. Catch per unit effort could be used as a measure for catchability because all captured pike were immediately returned to the pond and mortality was low. Catchability to spinner fishing decreased to very low levels after about half of the population had been caught in this way. Catchability to live bait fishing remained unaffected both by intensive spinner and live bait fishing. It was difficult to capture pike more than once by spinning. In live bait fishing, on the other hand, the number of recaptures closely matched the number expected if catchability remains unaffected by earlier capture. The advantages are discussed of the use of artificial baits over live baits in hook and line fishing for pike. (Auth.)

12466. Elliott, J. M. (Freshwater Biol. Assoc., Far Sawrey, Ambleside, Westmorland, England). 1970. DIEL CHANGES IN VERTEBRATE DRIFT AND THE FOOD OF TROUT Salmo trutta L. J. Fish Biol., 2(2): 161-165.

Diel changes in the stomach contents of 0+, 1+ and 2+ or older trout were compared with diel changes in invertebrate drift. Peaks in mean numbers and biomass of invertebrates per fish stomach occurred in the midday (10.00 to 14.00 h) and evening (18.00 to 22.00 h) samples. The major peak in biomass was in the midday sample for 2+ fish. There was a good correlation between diel changes of benthic invertebrates in the diet and drift, with the major peak in the evening. A similar relationship did not always exist for emerging and terrestrial invertebrates. Known non-drifting benthic invertebrates (e.g. large caddis larvae) were excluded from the comparisons, and were only taken by 2+ or older trout in which they contributed a large biomass to the day food. (Auth.)

12467. Molnár, Gy., and E. Tamássy (Zool. Inst. of the Univ. for Agric. Sci., Gödöllő, Hungary). 1970. STUDY OF THE HAEMOGLOBIN CONTENT OF A SINGLE ERYTHROCYTE (MINDEX) IN VARIOUS CULTURED FISH SPECIES. J. Fish Biol., 2(2): 167-171.

Investigations of the erythrocyte count, haemoglobin content and Mindex of 7 fish species were performed under equivalent environmental conditions in the same period of the year. The species were: bighead Hypophthalmichthys nobilis (Richardson), carp Cyprinus carpio L., silver carp Hypophthalmichthys molitrix (Val.), grass carp Ctenopharyngodon idella (Val.), sheat-fish Silurus glanis L., pike Esox lucius L., pike-perch Lucioperca lucioperca (L.). Bighead and carp are carnivorous and omnivorous, silver carp and grass carp are herbivorous and sheat-fish, pike and pike-perch are predatory. Significant differences were demonstrable between M values of fish living on different type of food, where the Mindex is:

$$M = \frac{\text{haemoglobin, g\%}}{\text{erythrocyte count}} \cdot 10^6.$$

It is concluded that Mindex values are useful as one parameter differentiating between fish with distinctly different food habits. (Authors)

12468. Hardisty, M. W. (Bath Univ. of Technol., England). 1970. THE RELATIONSHIP OF GONADAL DEVELOPMENT TO THE LIFE CYCLES OF THE PAIRED SPECIES OF LAMPREY, Lampetra fluviatilis (L.) AND Lampetra planeri (Bloch). J. Fish Biol., 2(2): 173-181.

Gonadal development has been studied throughout the larval period of Lampetra fluviatilis and comparisons have been made with conditions in the larvae of the closely related non-parasitic species, L. planeri. The two forms differ in the time of onset of mitotic division in germ cells and in the period when oogenesis is initiated. These phases begin in L. planeri when the ammocoetes are one year old and in L. fluviatilis at the end of the second year. The course of sex differentiation appears to be similar in both forms. While in the early stages, the oocytes of L. planeri are larger than those of L. fluviatilis at comparable ages, by the end of the third year, they are similar in size in both species. It is suggested that in L. planeri, during the extension of the larval period, gonad growth is retarded and during this phase the ammocoete accumulates body reserves which are used to meet the metabolic requirements of the rapidly developing gonads after metamorphosis. The differences observed in early gonadogenesis are believed to account for the reduced fecundity of the L. planeri ammocoete and their adaptive significance is discussed. (Auth.)

12469. Jones, A. Neville (South-west Wales River Auth., Penyfai House, Llanelli, Wales, England). 1970. A STUDY OF SALMONID POPULATIONS OF THE RIVER TEIFY AND TRIBUTARIES NEAR TREGARON. J. Fish Biol., 2(2): 183-197.

Population estimates of Salmo salar L. and Salmo trutta L. were made by electrofishing at 39 stations spaced along the main river and tributaries. Within the tributaries there was a tendency for the standing crop, the average weight of individual fish and the proportion of juvenile salmon to trout to decline in an upstream direction. The survey included an assessment of a salmon alevin restocking project. (Auth.)

12470. Mulcahy, M. F. (Dept. of Zool., University College, Cork, Eire). 1970. BLOOD VALUES IN THE PIKE Esox lucius L.. J. Fish Biol., 2(3): 203-209.

The ranges and mean values of haematocrit, red cell, white cell and differential cell counts, red/white cell ratio, red cell fragilities, haemoglobin levels and serum protein concentrations of adult pike Esox lucius L. have been measured, and the serum electrophoretic patterns on cellulose acetate and polyacrylamide gel described and discussed. It is hoped that these blood values will provide normal standards for the pike since normal ranges are wide, and isolated measurements therefore of limited value. (Auth.)

12471. Brown, V. M., and R. A. Dalton (Water Poll. Res. Lab., Stevenage, England). 1970. THE ACUTE LETHAL TOXICITY TO RAINBOW TROUT OF MIXTURES OF COPPER, PHENOL, ZINC AND NICKEL. J. Fish Biol., 2(3): 211-216.

The acute lethal toxicities to rainbow trout, Salmo gairdneri Richardson, of mixtures of copper and phenol, of copper, zinc and phenol, and of copper, zinc and nickel, over an exposure period of 48 h were determined. The concentrations selected for testing were such that each poison theoretically contributed equally to the toxicity of the mixture. It was found that the toxicities of these mixtures could be adequately predicted by summation of the fractional toxicities of the particular poisons which were present. (Authors)

12472. Hodkinson, M., and A. Hunter (Dept. of Biology, Univ. of Salford, England). 1970. GROWTH CONTROL OF Saprolegnia FROM UDN-INFECTED ATLANTIC SALMON Salmo salar L.. J. Fish Biol., 2(3): 245-248.

Nine antiseptic compounds, at concentrations ranging from 0.1 to 0.0001%, were tested in vitro for their ability to inhibit the growth of Saprolegnia. This fungus was isolated from suspected UDN-infected Atlantic salmon. Malachite green was the most effective antiseptic. Fungal growth was completely inhibited at all the concentrations tested. (Authors)

12473. Marlborough, D. (42 Stanborough Green, Welwyn Garden City, England). 1970. THE STATUS OF THE BURBOT Lota lota (L.) (GADIDAE) IN BRITAIN. J. Fish Biol., 2(3): 217-222.

Records of burbot Lota lota (L.) captures from the early nineteenth century to the present have been gathered and arranged watershed by watershed in chronological order. Most are from eastward-flowing river systems from Durham southwards to the Great Ouse, but a few records from westward-flowing systems are considered. In many areas the records imply a decline of burbot numbers and distribution during the present century, though burbot may never have been more than locally abundant. Local over-fishing, pollution and habitat changes are considered the most likely causes of decline. Conservation measures seem desirable. (Auth.)

12474. Roberts, Ronald J., W. M. Shearer, K. G. R. Elson, and A. L. S. Munro (Dept. of Pathol., Univ. of Glasgow Vet. School, Glasgow, Scotland). 1970. STUDIES ON ULCERATIVE DERMAL NECROSIS OF SALMONIDS. I. THE SKIN OF THE NORMAL SALMON HEAD. J. Fish Biol., 2(3): 223-229.

The skin of the head of adult Atlantic salmon S. salar L. was examined by light and electron microscopy. The general structure resembled that of most other vertebrates, but in common with other fish, the melanocytes were restricted to the papillary layer of the dermis. The mucus secreting cells were shown to elaborate a series of separate membrane bound vesicles of secretion. The basement-membrane was complex, with a system of primary, and secondary, micropapillae showing close adherence to the bases of the epithelial cells, which were modified to form a thick, electron dense basal plasma membrane. No evidence to suggest a reason for the localization of the early lesions of ulcerative dermal necrosis to specific areas of the epithelium of the head was adduced. (Authors)

12475. Cross, D. G. (Salmon and Freshwater Fisheries Lab., Ministry of Agric., Fisheries and Food, Whitehall Place, London, England). 1970. THE TOLERANCE OF GRASS CARP Ctenopharyngodon idella (Val.) TO SEAWATER. J. Fish Biol., 2(3): 231-233.

Laboratory tests were conducted to determine the tolerance of 2+ grass carp to an oceanic water. It was found that at a temperature of 20.1°C ± 0.4°C the maximum survival times of the fish in concentrations of seawater equivalent to 17.5 and 10.5 g/l sodium chloride were 5 h and approximately 24 days respectively. The importance of these results lies in the consideration of the possibility of grass carp migrating through brackish or seawater from one river system to another. Such a migration would seem to be impossible through seawater but may be possible through brackish water. (Auth.)

12476. Lee, Fah Onn, and Thomas C. Cheng (Dept. of Biol., Lehigh Univ., Bethlehem, Pennsylvania). 1970. THE HISTOCHEMISTRY OF Stellantchasmus falcatus Onji and Nishio, 1915 (TREMATODA: HETEROPHYIDAE) METACERCARIAL CYST IN THE MULLET Mugil cephalus L. AND HISTOPATHOLOGICAL ALTERATIONS IN THE HOST. J. Fish Biol., 2(3): 235-243.

The metacercarial cyst of the heterophyid trematode Stellantchasmus falcatus in the striated muscles of the mullet Mugil cephalus consists of three layers. Histochemical studies have indicated that these layers are chemically distinct. The acellular inner layer is comprised of complex carbohydrate polyanions rich in acidic groups while the medial acellular layer is comprised of a neutral mucopolysaccharide including a moiety of carbohydrate polyanions. These two layers are believed to be of parasite origin. The outer layer is cellular and is of host origin. It is the most chemically complex and is believed to include one or more of the following: mucopolysaccharides, glycolipids and phospholipids. In addition, the carbohydrate moiety associated with the mucopolysaccharides and/or glycolipids is in the form of sulphated carbohydrate polyanions with undissociated carboxyls as well as acidic groups. The presence of the parasite results in the necrotic degeneration of the host's myofibers situated in the proximity of the parasite. Large fat cells fill the spaces vacated by necrotic muscle cells and many blood cells occur along the periphery of the parasite. (Authors)

12477. Tan, Yee Thong (Tropical Fish Culture Res. Inst., Malacca, Malaysia). 1970. COMPOSITION AND NUTRITIVE VALUE OF SOME GRASSES, PLANTS AND AQUATIC WEEDS TESTED AS DIETS. J. Fish Biol., 2(3): 253-257.

The composition and nutritive value of different diets, namely the aquatic weeds - Hydrilla verticillata (L. F.) Presl., Lemna gibbs (L.), Pistia stratiotes (L.), grasses — Guinea grass Panicum maximum Jacq., Napier grass Pennisetum purpureum Schum. and plants — sweet potato leaves Ipomaea batatas L. and tapioca leaves Manihot utilissimus Pohl. were determined and compared. The diets contained 13.5 to 30.48% protein; 1.89 to 9.60% fat; 3.94 to 23.13% ash; 5.42 to 26.70% fibre and 24.87 to 46.27% carbohydrate. Most of the minerals determined in the aquatic weeds were higher than those in grasses and plants. The feeding of Hydrilla, Napier grass and tapioca leaves to grass carp Ctenopharyngodon idellus (V.) showed a different growth rate and the results obtained indicated the superiority of Hydrilla diet over Napier grass and tapioca leaves. (Auth.)

12478. Campbell, J. S., and H. R. MacCrimmon (Dept. of Zool., Univ. of Guelph, Guelph, Canada). 1970. BIOLOGY OF THE EMERALD SHINER Notropis atherinoides Rafinesque IN LAKE SIMCOE, CANADA. J. Fish Biol., 2(3): 259-273.

The study of the emerald shiner Notropis atherinoides Rafinesque was conducted in 1967 and 1968 in Lake Simcoe, a eutrophic inland lake with an area of 725 km^2 situated in the province of Ontario, Canada. On the basis of meristic characters, the emerald shiner of Lake Simcoe conforms to the classical description of the species and is not distinct from the form inhabiting the Great Lakes. Annulus formation occurred in early June on age I fish but second and third annuli were not formed on older fish until late July through August. Young-of-the-year emerald shiners reached a total length of 45 mm by October; age I were 81 mm and age II measured 92 mm by the same month. By September, age I female emerald shiners attained a size superiority of 5 mm over males of that age group and by the end of the third summer age II females exceeded age II males by 8 mm. Spawning occurred offshore in the latter part of July when surface water temperatures approximated 20°C. Differences in water temperature seem to strongly influence the seasonal distribution pattern of the emerald shiner. The final temperature preferendum of the species, as determined in a vertical temperature gradient tank, was 25°C. The emerald shiner is extensively utilized as a bait fish by anglers and appears to be an important forage fish. The plasticity of the species to adapt to a variety of ecological conditions and the species potential for high production favour its introduction to waters requiring a good converter in the food chain. (Authors)

12479. Fagerlund, U. H. M., and Edward M. Donaldson (Fish. Res. Bd. Can., Vancouver Lab., Vancouver, British Columbia, Canada). 1969. THE EFFECT OF ANDROGENS ON THE DISTRIBUTION AND SECRETION OF CORTISOL IN GONADECTOMIZED MALE SOCKEYE SALMON (Oncorhynchus nerka). General and Comparative Endocrinology No. 12, pp. 438-448; Studies, Fish. Res. Bd. Can., Part 2, No. 1338, p. 169, 1970.

12480. FAO of the United Nations, Rome Italy. 1970. FAO FISH CULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF FISH CULTURE RESEARCH AND DEVELOPMENT. FAO Fish Cult. Bull., 2(2): 28 p., illus.

Text includes: From research institutions... Induced breeding - Polyspermous fertilization in cyprinids - Carp selection - Selective breeding of lobster - Hybridization and culture of hybrids - Propagation of shrimps and prawns - Breeding of pike-perch - Fertilization of brackish-water ponds - Fish feeds - Culture of fish food organisms - Fish feeder - Weed control - Control of predatory fishes - Catfish culture in brackish waters - Culture of fathead minnow - Culture of scallops and clams - Dover sole culture in recirculated water - Winter storage of tilapia - Thermal aquaculture - Oxygen demand and salinity tolerance - Removal of iron from well water supplies - Biology and culture of frogs. Fish culture development Argentina - Canada - Cuba - Czechoslovakia - France - Hong Kong - India - Israel - Ivory Coast - Kenya - Philippines - Thailand - United States. Fish diseases

and their control... Infectious dropsy in carp - Ichthophthirius - Sacramento river chinook disease in salmon - Import regulations for disease control - Residues from feed additives and medication on fish - Effect of feeding diseased maize to fish. Fish introductions ... Recent introductions - Results and evaluations of recent introductions, in various regions - Orange river yellowfish into Lake Kyle, Rhodesia - Fish introductions in Tunisia - Fish introductions in Morocco. Meetings and symposia. FAO's current field activities in fish culture. International Biological Programme (IBP): Section Marine Productivity (PM) ... Theme D. 1: Worldwide studies of selected organisms - grey mullets. (From contents)

12481. FAO of the United Nations, Rome, Italy. 1970. FAO FISH CULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF FISH CULTURE RESEARCH AND DEVELOPMENT. FAO Fish Cult. Bull., 2(3): 24 p., illus.

Text includes: From research institutions ... Artificial propagation - Pompano culture - Intensive carp culture - New fish feed - Index of feeding habits - Culture of croaker - Shrimp culture - Crayfish culture - Cryopreservation of oyster gametes - Oyster culture - Mussel culture - Thermal aquaculture - Temperature tolerance - Pen rearing of salmon - Pollution and occurrence of diseases. Fish culture development ... Cambodia - Canada - China (Taiwan) - Madagascar - Nigeria - Philippines - Romania - South Africa - Sweden - Thailand - United Kingdom - United States - U. S. S. R. - Yugoslavia. Fish diseases and their control ... New virus disease in carp - Residues from medication - Methylene blue treatment for bacterial infection - Blood flagellates - Ichthyophthiriasis of carp in winter - Eye fluke in Danish trout farms - Hearings on United States Fish Disease Bill - Laws and regulations on international traffic in live fish and fish eggs. Introduction of fish and shrimps ... Recent introductions - Transport of sturgeon - Bilateral exchange of fish. Meetings and symposia. FAO's current field projects in fish culture ... UNDP/SF projects - UNDP (FUNDWI) project - UNDP/TA projects - FFHC projects - WFP projects. (From contents)

12482. FAO of the United Nations, Rome, Italy. 1969. FAO FISH CULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF FISH CULTURE RESEARCH AND DEVELOPMENT. FAO Fish Cult. Bull., 2(1): 24 p., illus.

Text includes: From research institutions ... Induced breeding - Hybridization and culture of hybrids - Equipment for differentiating sexes - Use of tranquillizers - Pond fertilization - Weed control - Cage culture - Thermal carp culture - Catfish culture - Pompano culture - Propagation of shrimps and prawns - Oyster culture - Heat balance in ponds - Metal toxicity to carp fry. Fish Culture Development ... Ceylon - China (Taiwan) - Costa Rica - Cyprus - Czechoslovakia - France - Indonesia - Israel - Laos - Netherlands - Romania - Spain - Thailand - United States. Fish Diseases and their control ... Major infectious fish diseases in the United States - Control of trout diseases in New Zealand - Whirling disease - Protozoan parasites - Carp dropsy - Bacterial diseases - Anchor worm. Recent introductions of fish, shrimps and oysters ... Introduction of Chinese carps - Heterotis niloticus. Meetings, symposia, workshops and training centres. FAO's current field activities in fish culture ... UNDP/SF projects - UNDP/TA projects. (From contents)

12483. Burnet, A. M. R. (Fisheries Lab., Mar. Dept., Christchurch, New Zealand). 1970. SEASONAL GROWTH IN BROWN TROUT IN TWO NEW ZEALAND STREAMS. N. Z. J. Mar. Freshw. Res., 4(1): 55-62.

Brown trout Salmo trutta Linn. were marked with individual tags and recaptured throughout a year in two small Canterbury streams. The growth recorded showed a marked seasonal variation which differed in pattern in the two streams. There was a considerable difference in the growth rate between the two populations and fish transferred from the slow-growth stream to the faster-growth stream showed an immediate response to the change. (Auth. summ.)

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